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[ILLUSTRATED.]

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How to Become an Electrical Engineer.

At a recent meeting of the Polytechnic Society of Berlin, the question was asked: What studies are best to fit one to be an electrical engineer? Herr Frischen, one of Siemens & Halske's experts, replied that much practical experience was required After graduating from school, a rigid course in an advanced technical school should be taken, followed by an apprenticeship in a factory. He remarked that at present the title of electrician is used too freely, and that the claim of some to it that they have nailed up a few wires.

New Uses for Electricity.

"The light-outspeeding telegraph," said Emerson, in one of his poems in 1846, "bears nothing on its beam"—but it did, even then; it bore from city to city at least the market price of whisky. And if to such base uses the thunderbolts of Jove can be applied—thus misusing a force which enwraps the key to the mystery that lies around the very gates of life—if the august lightnings of heaven may be so abused, why need any one be astonished to learn that among the latest devices for the amusement and depravity of men (and women!) is "bull fighting by electricity!" It seems a little late in the century for such barbaric sport—which would better befit the brutal scenes once enacted in the amphitheater of Vespasian at Rome—and it sounds strange to hear of such things almost on our own border. But the mysterious element that in one form is utilized to bring the news of the performance, was used in another shape last night in the city of Mexico to light up the arena for a bull fight. Owing to the novelty of this part of the performance, "an immense crowd" was attracted to the scene—President Diaz and the members of his cabinet being among the spectators. "The arena was brilliantly lighted by ten electric lights," and the dazzling blaze seemed to infuriate the bulls. The first one quickly killed four horses and tore open and disabled as many more, flung one swordsman, nearly dead, over the bars, disabled the matador and several picadors, and ramped around the arena the lord and master of the situation. These things are highly relished still in Spain—and our neighbor republic on the southwest is more Spanish than American. How much better are such scenes than those of the Colosseum—the "thumbs down" spectacles—in which human beings instead of bulls were the sacrifices? And what must be the influence of such exhibitions on the people who uphold them?

A New Telegraph Relay.

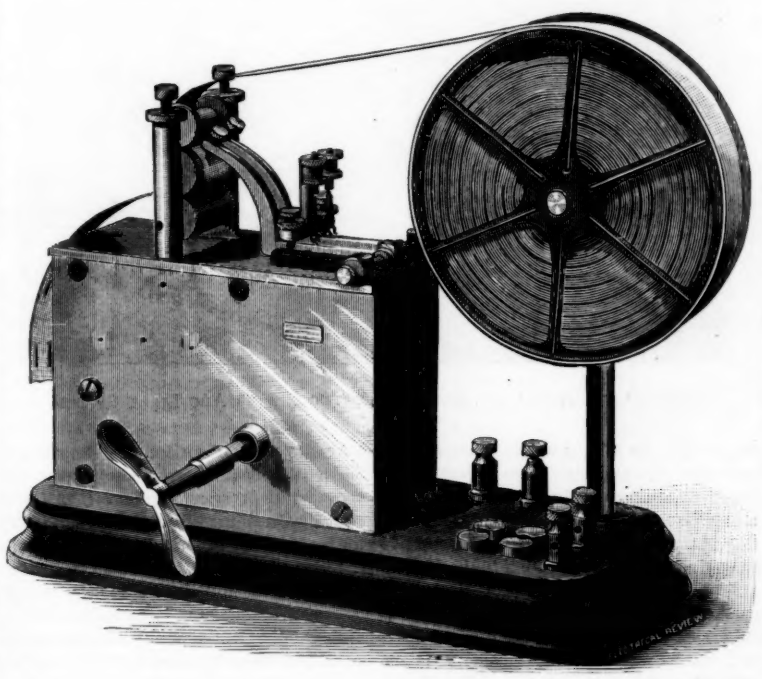
A new telegraph relay is the invention of Mr. Lahmeyer, of Aix-la-Chapelle. An electro-magnetic coil surrounds an upright glass tube closed at each end, partially filled with mercury and in which an iron plunger floats. Now, it is easy to see that the magnetic effect of throwing a current through the coils will be to draw the plunger—the solenoid core—down, and raise the mercury by displacement. Just above the level of the mercury in the tube are two platinum contacts in a local circuit, and every time the mercury rises it closes there.

Pyro-Electricity.

At a meeting of the French Physical Society, M. Duhem recently opened a discussion on the question of the connection between the phenomena of thermo-electricity and the electrification of a tourmaline when heated, which is known as pyro-electricity. According to an old theory of Gaugain, the co-ordination of the phenomena is not difficult. A plate of tourmaline, cut normal to the axis, exhibits when heated opposite electrification upon its two poles (which differ externally in the form of their faces), while the signs of the electrification change places when the crystal is cooled. Now, if the existence of this internal E.M.F. is due to a cause similar to that which determines thermo-electric E.M.F., two conditions should be fulfilled. 1. A difference of temperature must exist between different portions of the tourmaline plate. 2. The structure of the plate must be heterogeneous. Both these conditions are evidently fulfilled. There is a difference of temperature between the inside and the outside of the plate, and the crystalline condition provides the required heterogeneity in the molecular structure. The phenomenon of piezo-electricity (or the development of the electric condition by subjecting certain crystals to compression) may also, according to M. Duhem, be brought under the same denomination if we consider the effects to be primarily due to heat disengaged during the compression of the crystal. M. Currie agreed that the phenomena of pyro and piezo-electricity had a common origin, namely, the deformation of the crystal. But he could not admit that they were identical, or that the latter was due to the development of heat by compression. The amount of heat so developed was far too small to account for the observed degree of electrification.

Central Electric Light Stations.

As already reported in *Industries*, an electric light station has been established in the Passage des Panoramas, the original contractor being M. Henry Liepmann (not the professor), who has now sold the undertaking as a going concern to the Societe Electrique The engines are placed in the cellar of the establishment known as the Bains de la Presse, and instead of paying a rental the company furnishes light and hot water to the proprietors of the bath. At present, 850 Woodhouse & Rawson lamps of 10 candle power are fixed in various restaurants, cafes, shops, and in the Theater des Varietes; 400 lamps more have been contracted for in the neighborhood, making a total of 1,250 lamps. To supply current for this number of lamps will require some additions to the plant, and these will be made during the coming summer. The current is supplied by compound wound Gramme dynamos. The example of Chateaulin is being followed by Bruyeres, a small town of 3,000 inhabitants in the Department des Vosges, about fifteen miles from Epinal, where the River Arentelle furnishes abundant water power, which will be utilized for driving dynamo machines. The installation is being put up by the Maison Breguet, of Paris, and will at first only comprise 100 glow lamps; but it is to be extended if the demand for light should increase.



WESTERN ELECTRIC CO.'S NEW DOUBLE PEN REGISTER.

New Double Pen Register.

The double pen register made by the Western Electric Company of New York, was the first one introduced in the district telegraph business, and has always been considered one of the best. To meet the competition of cheaper apparatus they have made the register shown in the cut which embodies all the good points of the former style, but by changes in mechanical construction is less costly. Prominent district telegraph men to whom it has been submitted have pronounced it either equal or superior to the former style.

The Electric Club Management.

The first meeting of the newly-elected board of managers of the Electric Club was held at the club rooms last Thursday evening, May 12th. There was a full attendance, and the present success and brilliant promise of the future of the club was discussed earnestly and at length. Committees were appointed as follows:

House Committee.—M. W. Goodyear, chairman; Geo. B. Coggeshall Charles Dutton, C. O. Baker, Jr., H. A. Reed.

Entertainment Committee.—Dr. Otto A. Moses, chairman; W. D. Sargent, Henry Hine, C. L. Buckingham, C. H. Barney, C. W. Price.

Reception Committee.—Geo. Worthington, chairman; Geo. M. Phelps, Jr., M. T. Davidson, L. E Curtis, H. R. Garden, W. S. Hine, F. R. Hastings, Frank G. Stone, F. W. Toppan, H. L. Storke, John B. Powell, Geo. L. Beetle, Geo. F. Porter, W. L. Candee, H. D. Stanley, C. H. Barney.

Committee on Welfare of the Club.—Horace B. Miller and John W. Beane, New York; John I. Sabin, San Francisco; C. A. Brown, Chicago; T. B. Doolittle; Bridgeport, Conn.; A. V. Garratt, Boston; James English, New Haven; A. J. De Camp, Philadelphia.

A special committee with authority to arrange all matters connected with summer meetings at the seashore was appointed by President Davis, consisting of Messrs. Dutton, Baker, and Price.

The applications of over twenty new members were passed upon favorably, after which the board adjourned to meet one week later on the occasion of the regular monthly discussion.

New Street Station Box.

The Police Telephone and Signal Company, whose headquarters are in Chicago, has just brought out a new box for street station purposes. The street station sometimes—and perhaps better—known as a sentry box, contains within its outer locked door, a box not unlike that of a fire alarm box. This inner box, which is also locked, has an outer and an inner door. Opening the outer door discloses a "pull down" handle, which turns in an alarm at the central station. On opening the inner door the working apparatus of the telephone connections are discovered and vocal communication may thus be had between the patrolmen or officers at the box, and the central station.

To the outside door of this inner box there is one lock and a single keyhole accessible; but to this there are two quite different keys. Now, if one of these—the ordinary patrol key—is used to unlock the door, the signal which will be sent in by the "pull down" lever will be for a patrol wagon; but if the other key be used, that same "pull down" lever will send in a fire call.

The whole thing is as simple as putting your finger in your eye, but it can no more miss fire than a school boy can get through a season of puppy love without crying. All one has to do is to use the right key to accomplish the required result, and the "pull down" has no choice in the matter.

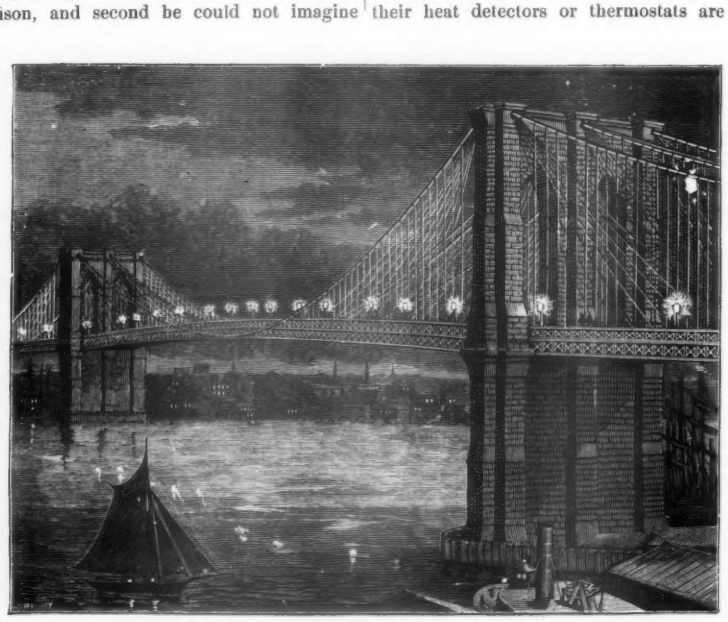
The Bridge and its Lights.

There is no one feature of New York that attracts more attention than the great East river bridge, connecting New York and Brooklyn. Every new-comer to this city makes it a visit and receives lasting impressions of its grandeur. One element that largely adds to this great triumph of engineering skill, is the brilliant and effective double line of electric arc lights that to the number of nearly 100 light up the entire length of the bridge and approaches, a distance of one and one-fourth miles. The view of the bridge from down the bay, at night, is an ever beautiful and imposing one, and the multitudes traveling on the East river and bay boats never weary of the view. Although these electric lights have been mentioned before, we think it of interest to make this additional mention of the continued interest in their effectiveness, and to illustrate the bridge as it appears to an observer down the bay. The lights are of the system of the United States Company, the station being located under the Brooklyn approach. A number of electrical visitors, through the kindness of Chief Engineer Martin, visited the plant this week and noted the compact arrangement of the five dynamos and three engines, two Corliss and one Armington & Sims. The station is kept neat and clean.

Improvements in Fire Alarms.

Paper By A. H. Kendall.

The sharp competition of to-day is forcing business into conditions where it can obtain only reduced profits which formerly would not have been considered to be an equitable remuneration for the capital invested. And these sparse profits in commercial affairs and manufacturing enterprises are now made out of what was wasted a few years ago. One of these items is the fire waste as represented in the cost of insurance, which is of course strictly based on the actual destruction of fires. The general consideration of insurance a few years ago was treated as an act of fate. There was but little elasticity in the matter of insurance rates, and if any economy was exercised, it was in the reduction of the amount of insurance rather than seeking to diminish the rate, and still preserve an amount of insurance adequate to indemnify the assured to an equitable degree in case of fire. The systematic effort to reduce the rate of insurance by improved construction and fire protection, is one of the most modern features of business. The aggregation of values in our business centers with large buildings closely crowded together, and the augmented fire hazards from these conditions, as well as from the greater speed of machinery, and the introduction of many processes in industrial chemistry such as drying at high temperatures, and the wide use of artificial light, have increased the risk of fire to an extent far beyond the conditions of less than a generation ago. At the same time, the defenses against fire have been increased. Our fire departments have been developed until both in organization and equipment, they resemble a standing army. The power of the law is exercised in the same direction, limiting the quality of illuminating oil, its methods of storage and sale, and in cities, the construction of buildings to the utmost detail practicable with enforcement. But, nevertheless, the terrible ravages of fire show that these precautions have not kept pace with the increasing conditions of hazard, and I offer a few words in explanation of the latest application of modern science to this problem as represented by the Martin-Wilson Automatic Fire Alarm, its function being that of an ever vigilant custodian by its instantaneous operation to sound an alarm which will save the precious seconds at the beginning of every fire, and summon the assistance of the fire department and other help at the earliest moment. Capt. John S. Damrell, for many years the chief of the Boston fire department, and now at the head of the Bureau of Building Inspection, once uttered a great truth in saying that a great fire was a neglected small one. I have read that in every theatrical company there is a person called an understudy, whose duty it is to take the place of the star or prima donna when unable to appear. And it is with much reluctance that I am compelled to appear as an understudy on this evening, as imperative engagements connected with building and equipping our new central alarm station, in Boston, have prevented Mr. Martin from making the preparation necessary for a presentation before you of a paper on the Automatic Fire Alarm system, bearing his name. I will frankly state that my position in the company merely requires steady and hard turning of the crank, and very fortunately, for the system is so simple in itself that there is no necessity for an erudite knowledge of the principles of electricity for its management, and therefore my little speech is only a formulated statement of statistical facts, and not a gorgeous illustration of the proverb that "fools rush in where angels fear to tread." Mark Twain once said that the best introduction he ever had to an audience was from a gentleman who said he only knew of two facts about him, first, he had never been in State's prison, and second he could not imagine why. This, he said, simplified matters, and prevented the audience from expecting too much and consequent disappointment. I trust it may be so in my case. I purpose submitting some facts relative to thermostats in general, and their application to the Martin-Wilson Automatic Fire Alarm System in particular, with a comparison of the different systems of application; and will further say, that by way of reinforcement, the inventors of the system are present and will give assistance in making answers to questions which may be made by any in the audience. It is useless at this late day, when the losses by fire in the United States are so heavy that fire insurance has almost ceased to be a profitable business, to go into the question of the value of an automatic fire alarm. Any invention or application that is absolutely certain to automatically indicate the location of a fire in a building in its incipiency before it has had time to do much damage, and when it can be easily extinguished, deserves the earnest attention of insurance companies, property owners, capitalists, and the general public.



Brooklyn Bridge Installation.—United States Arc Light System.

The Boards of Underwriters of this and other cities, composed of men who have made a life study of reducing the terrible risk of fire to a minimum, officially approve and urgently recommend the use of the automatic fire alarm, offering to reduce the rates of insurance on property equipped with our alarm to such an extent that its introduction affords a very material saving, as the diminution of the cost of insurance will often more than pay for the cost of maintaining the system, so that direct financial gain accrues to insurers, in addition to the greater value of the protection resulting from its introduction. This automatic fire alarm is continuous and omnipresent in the matter of exerting a constant espionage, while under the most favorable circumstances a watchman can visit each room only once or twice an hour, and his discovery of fire is either too late, or he fails in the exercise of the presence of mind and judgment necessary to render any material service. He may be overcome or disabled by sickness or accident. Too often he is selected from among those unfitted for vigorous labor, and may not be faithful to the trust of watching the property placed in his charge. With our automatic fire alarm, there is the increased sense of security, in the certainty of a constant and sleepless watch with an unceasing vigilance for every second in the 24 hours. Like the telegraph and telephone, the idea is nothing new, but as it was with them so it is with us; large sums of money and years of time have been spent in patient and careful experimental work and study which has resulted in our present closed circuit system.

The foundation of an automatic fire alarm is the heat detector, and the Martin-Wilson Automatic Fire Alarm Company claim that their heat detectors or thermostats are at once the most scientific, the simplest, and the most reliable instruments yet invented, and that their system of electrical circuits and apparatus used in connection therewith for the purpose of sounding a fire alarm by the heat of the fire itself, cannot be excelled. The idea of utilizing electricity to give notice of undue heat is by no means a new one. But the great difficulty has hitherto been in its execution, from the fact that a fire being a comparatively infrequent occurrence in any one building, the circuits by reason of an accidental break, earth connection, or a weak battery, would be apt to be in an inoperative condition, when a fire occurred, and so fail to do the work expected of them. In 1830, Dr. Ure, the celebrated English chemist, invented a thermometer in which the movement of a spring composed of two unequally expansible substances, for instance brass and steel, indicated the temperature to which it was exposed. This instrument he called a thermostat, and he utilized its motion to regulate the valves or dampers of furnaces, and since that time thermostats and thermometers embodying the same principle have been devised by different inventors. A familiar example being the common metallic thermometer. From 1830 to 1881 numerous thermostatic heat detectors were invented, based on various principles such as the expansion of metals and air, beeswax and similar substances, and the rending or rupturing of fragile vessels by the vaporization of volatile liquids such as alcohol, ether, etc. Nothing so practical or so reliable as the metallic expansion thermostat of Dr. Ure was, however, produced until 1881, when Mr. M. Martin, of Boston, invented a thermostat in which the low boiling or vaporization points of such fluids as ammonia, alcohol, ether, naphtha, etc., was successfully utilized to control an electric current, and give an alarm when a determinate temperature was reached. In the Martin thermostat, a very small quantity of a suitable fluid is hermetically sealed within a thin metallic disk-shaped capsule or tank, having one of its faces made of a very flexible sheet copper, and slightly concave, while the other face is comparatively rigid and unyielding under pressure. The application of heat volatilizes the contained liquid, and the expansive power of the vapor thus generated bulges the flexible face outward, into a convex form, with great force. And this movement is used to open or close an electric circuit, as may be desired. Perhaps it would be as well to assume, at this point, that there may be some in the audience who are not fully informed in regard to the difference between what is technically known as a closed circuit and an open circuit, the latter being where the two wires both start from the battery, one from the negative pole, the other from the positive, and are separated at any point. Thus at the points A and B, as they stand, there is no current, consequently no decomposition in the plates in the battery, the continuous current being produced by that decomposition which sets in through the acid in which the plates are immersed the instant the two ends of the wire are joined together and the circuit closed. In an open circuit the alarm is caused by the starting up of the current, which is supposed to be constantly in readiness to act. But, as will be explained to you later on, there are a number of possible and probable conditions, which, given their existence, no current can start; and it can never be known if these conditions do exist until you attempt to start the current Another form of circuit may be made with a wire and what is called a ground. Thus the separation as before at A and B.

Close up the gap, and the current immediately sets up through the earth, which, as you see, completes the circuit. A closed circuit, on the other hand, as its name implies, gives a continuous current, which is either metallic or ground, as in the open illustration; and the alarm is given by any interference or weakening of the current. Consequently it is always testing itself, and any complication that in any way interferes with its perfect working, at once sounds its own alarm. So you will at once perceive that, other things being equal, the closed circuit is, without question, far superior to the open, inasmuch as in one we hope for the warning, in the other a failure to receive it is an electrical impossibility. What has heretofore prevented the general use of the closed circuit has been, first, the much greater expense, and, second, the supposed impossibility of making the different alarms intelligible and distinct in themselves; and that is why we are here to-night to make these explanations, and show you that the problem is solved in the Martin-Wilson fire alarm system. The electric door bell where the circuit is closed by the pressure on the knob setting up a current in the circuit which rings the bell, is one of the most familiar examples of an open circuit apparatus. After a long series of experiments with thermostats variously constructed, embodying the foregoing principles of operation, the Martin-Wilson Automatic Fire Alarm Company have finally adopted two—one an open and the other a closed circuit instrument—which they believe can scarcely be equaled for simplicity and effectiveness as practical heat detectors. In both forms, the tank or reservoir is held firmly suspended in a disk shaped frame, with its rigid face downward and its flexible face upward. The latter co-operating with the circuit controlling parts, which are attached to the rim of the frame, is slotted to freely admit the surrounding air to the surface of the tank, and also to protect it from accidental blows. While to exclude dust or dirt from the working parts, a cap or cover is closely fitted over the rim of the frame, great sensitiveness and little liability to injury or derange-

ment being thus secured. It will readily be seen from this description, that while the contact points operated by the movement of the upper surface of the tank are protected from dirt or dust by the cap or cover, the under surface is directly exposed to the air, which easily passes through the slots, in the supporting and protecting frame, and that any change in the temperature is very quickly communicated to the contained liquid. Hence the instrument is extremely sensitive, and at the same time is perfectly protected from injury or derangement of any kind, a combination of results hitherto unattainable.

The absence of delicate screw adjustments to vary the operative temperature.

The great energy with which they open or close the circuit.

All contacts are rubbing or frictional.

Quiescence of the sensitive and operative part until the specific temperature at which the alarm is given is reached. Entire freedom from false alarms by vibrations or jars.

The instruments are made in the most substantial manner, are nickel-plated and present a very ornamental appearance when placed on the ceiling of an apartment. Each has its operative degree plainly printed thereon, and we furnish reservoirs operative at any degree from 90 to 200 Fahrenheit. A reservoir may be used a great many times without injury, provided the heat applied is not too great. The neatest and most convenient way of connecting this thermostat in position is by means of porcelain knobs screwed into the ceiling about 4" on either side thereof—the knob serving to support both the instruments and the connecting wires.

Our system differs from every other in our method of using a closed circuit wherein the wires are constantly charged with electricity and always ready for service. Its service is not limited to giving an alarm of fire which is specific, indicating both by sight and sound the cause and location of the difficulty, but it also signals without giving a fire alarm anything tending to any interference whatever with the full operation of the system, such as any break, derangement of the system or weakening of the batteries before they become delicate, and consequently uncertain adjustments of contact points to vary the operative temperature—a feature so objectionable in most thermostats—are eliminated from this instrument as each reservoir operates at a certain definite temperature dependent on the character of the liquid contained therein, and as the reservoirs can be readily taken out of, or inserted in the supporting frame, the temperature at which it is desired any instrument shall operate is readily controlled. The two kinds of thermostats most used at the present time, are known as the mercurial and the metallic.

Thos. A. Edison, the celebrated electrician and inventor, in an interview on the prospective applications of electricity, published in the Boston *Herald*, some time ago, says in substance, that in the near future, losses from fire will become minimized in consequence of the outbreak of a fire and its exact location being automatically reported by means of electricity. The Martin-Wilson Automatic Fire Alarm Company confidently claim that the inventions and appliances necessary for the realization of Edison's prophecy are possessed by them alone, and that their perfected systems, the fruit of a long series of experiments, are destined to be universally used for the protection of property from the ravages of the devouring element.

Lighting the Hoosac Tunnel.

New England travelers have long received their most impressing experiences of "darkness which may be felt" within the Hoosac Tunnel. The lighting of the tunnel has often been proposed, especially since the perfection of electric appliances; but no practical test of their value within the great bore has ever been made. It is announced that such a test is to be immediately made, and that the required dynamo has been placed in the old air condenser building, near the eastern entrance of the tunnel. If the line of powerful lights to be suspended from the roof serve to fully illuminate the tunnel, an added interest will be given to its passage by the average traveler. The special boon of the success of the plan will be to the brakemen of the freight trains running through the tunnel. From the central shaft to each entrance, the railway has a decided incline. There is a necessity to set the brakes on every train, to check its rush down the grade from the center of the tunnel, and many brakemen have walked the car-roofs to death in the dampness and dark of the passage through the heart of the Hoosac.—*Worcester Gazette.*

On Regulating Series-Wound Transformers.

It is now a well-known though perhaps a somewhat unfortunate fact, that transformers of the ordinary type of construction, when used in the ordinary way, only yield constant difference of potential in the secondary circuit if supplied with current under the same condition in the primary. We say unfortunate, because the inherent defect of parallel working is not entirely obviated by the use of the transformer, and however high may be the E.M.F. employed, it is physically impossible to secure absolute constancy of potential in the mains. This objection has, we believe, already made itself felt in some of the installations already at work. A constant current system, if once the question of regulation is solved, not only avoids this difficulty, but it presents some other obvious advantages; both mains and transformers should, for instance, be cheaper to construct, and the potentials at the terminals of the primary coils would be lower. On the other hand, it is necessary to remark that the arrangements for working the alternating machines at a large central station present less difficulty under a constant potential than under a constant current service. In the former case, as the demand for current varies, machines can readily be cut out or added in parallel, while, as is well known, alternating-current dynamos are not capable of working together in series. Coming now to the kernel of the question: Can a series transformer be made self-regulating, and, if so, can it be done consistently with economical principles?

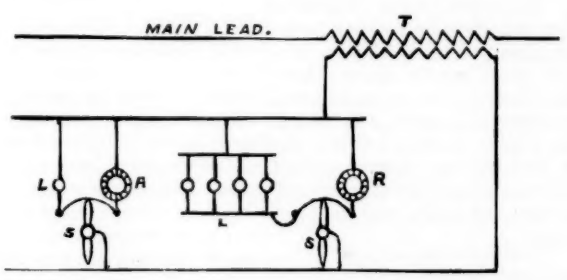


Diagram Showing Method of Regulating Series-Wound Transformers.

Experiment, in the hands of Mr. Rankin Kennedy (to speak only of one of its earliest exponents), says "No." Recent theoretical investigation, due to Mr. Kapp, has indicated the limits within which such a result can be approached, pointing out, however, that the conditions are not those of practice. Painful experience at the Grosvenor Gallery and elsewhere has emphasized the fact that no attempt to get round the difficulty by mechanical adjustment of the core (so as to vary the magnetic resistance) can possibly afford a practicable solution. There remain, however, at least two distinct directions in which it may still be open to question whether a solution is not yet attainable. One such method would consist in the application of some subsidiary regulating apparatus whose function should be purely electrical, and therefore automatic (any mechanical device may at once be ruled out of court). A second, and a better solution would be to hit upon some new principle of construction capable of directly fulfilling the required condition. Doubtless many electricians have been working on these lines, and it is satisfactory to be enabled to announce that perfect success has already attended the efforts which have been made in each of these directions, although for the present we are only in a position to publish details relating to the first named method.

It is now some months ago, that, at the invitation of Messrs. Sharp and Kent, of Westminster, we had the pleasure of witnessing the performance of an ingenious device, producing perfect self-regulation in the secondary circuit of a 2 horse power Gaulard-Gibbs transformer, under the condition of constant mean current in the primary coil. The apparatus is extremely simple and purely automatic in action, and, further, as will presently be shown, the energy consumed in regulation is really negligible. The device consists in providing for each lamp (or for each group of lamps which are turned on or off together) a small resistance coil wound with wire to carry the same current as the lamp, and so proportioned that the virtual resistance of the coil is equivalent to the actual resistance of the lamp—in other words, the resistance and self-induction of the coil are such that, if a lamp in any branch be replaced by a coil, the current flowing through that branch of the circuit will remain unaltered. The dimensions of the core (which takes the form of a closed ring) and the number of windings have therefore to be determined with reference both to the periodic time of the current and to the E.M.F. of the lamps. This being understood, it is easy to see that if each lamp or group of lamps is provided with such a coil, and the connections are made so that the act of switching off a lamp switches on the coil in its place, as shown in the figure, then the current through the secondary remaining unaltered, so also will the mean difference of potential at the terminals of the remaining lamps, there being nothing, in fact, to upset it. It will be noticed that the coils are entirely out of circuit so long as the lamps with which they are connected are in use. In practice the regulation so obtained is perfect. We found that when 10 lamps out of 12 were switched off the Gaulard-Gibbs (series-wound) transformer without using the coils, the Cardew voltmeter indicated a rise of E.M.F. of nearly 20 per cent., while with the coils in use it was impossible to detect any variation.

It remains to show that the energy expended in the coil which replaces the lamp is in reality quite trifling in amount. At first sight—especially to the student who is familiar only with continuous currents—it may be somewhat startling to assert that with mean values of E and I remaining absolutely constant, the energy expended in the circuit may be reduced to less than 1 per cent. of its initial value. Yet this enormous reduction is actually accomplished by Messrs. Sharp and Kent's induction ring; and the apparatus is thus well qualified to display some of the most interesting and important properties of alternating currents. The effect is, of course, due to the variation in the angle of retardation of the current over the impressed E.M.F. Now this angle—or rather its tangent—varies directly with L, the coefficient of self-induction, and inversely with the (actual) resistance R, so that when a coil, which has not only an enormously larger self induction, but also a very much smaller resistance, takes the place of a lamp, the lag is for both reasons increased, and the mean product of the simultaneous values of E and I is proportionately diminished.

T, series wound transformer; L, lamps; R, induction rings; S, two-way switch. But further, it is obvious that the whole of the work actually done in the coil must appear as heat, and, neglecting the small loss due to hysteresis, this heat, in the coil, as in the lamp, is measured by the mean square of the current into the real or ohmic resistance. The currents being the same, the work done in the two cases is therefore proportionate to their respective resistances. Now, the ohmic resistance of the coil has to be determined chiefly by the value that must be given to the coefficient of self-induction in order to make its virtual resistance equal to the real resistance of the lamp. This can be found from the formula.

$$S^2 = R^2 + (2\pi n L)^2$$

where S is the required virtual resistance, and n the number of alternations per second. If 100 volt 20 candle power lamps be used S will be about 160, and if n be 100, R will be negligible in this position, and the solution for L gives

$$L = .254.$$

Then, by properly proportioning the iron it is found perfectly easy to wind a coil to fulfill this condition which shall have a resistance not exceeding one ohm. If the periodic time be smaller, as it easily might be, then L, and consequently * R, would be still smaller.

But it has been already shown that the loss in regulation is expressed by the relative resistances of lamps and coils, which we now see to be as 1:160, and although to this something should no doubt be added on account of hysteresis, yet it certainly seems permissible to treat the loss as a negligible quantity.

We are not aware that Messrs. Sharp and Kent have made any actual measurement of the energy expended in the coils—which would, in fact, be somewhat difficult to determine with accuracy—but a rough and ready, though very practical, illustration of the saving of power was afforded by taking the governor off the engine and suddenly switching over from lamps to coils, with the result immediately apparent in the increased speed of the engine.

We have been much interested in these experiments, and cannot conclude our notice without expressing our admiration for the simplicity and ingenuity of the method. We shall perhaps shortly publish some further remarks on the theory of the action of the coils which, if followed out to its full extent, is in reality a little more complex than that here presented.—*London Electrical Review.*

Not a Volcano.

For only a couple of days last week the United States was sole possessor in fee-simple of a real, genuine, live volcano. Lava and smoke were clearly and plainly visible twenty miles away, and the effete monarchies of the other continent were notified by cable that hereafter we would neither borrow nor lend earthquakes nor volcanoes. Arizona had proved herself the pioneer in this new fake, and the steamship companies shuddered at the possible result of the tide of emigration being turned west-sou'-west, instead of east-nor'-east.

The bubble, alas! is broken. Our volcano has vanished in smoke, and Mexican smoke at that.

Bensen, Arizona, May 5.—The following telegram was just received from Fort Huachuca:

"A party which has just returned from the Whetstone Mountains says that the supposed volcano has turned out to be woods set on fire by Mexicans."

It is too awfully bad to have one's patriotic feelings, hopes and aspirations thus suddenly dashed to earth.

Making Death Painless.

The Pennsylvania Legislature has passed a bill requiring that all judicial executions for capital crimes in that State shall be accomplished by means of electricity. The most characteristic feature of the social philosophy of the age is its excessive sentimentality. Society appears to be more anxious to abridge the miseries and sweeten the punishment of such criminals as happen to fall under the sword of justice than it is to punish crime. If criminals were swiftly and sternly brought to justice there would be fewer to punish. The idea that punishment is to be made as mild as possible tends to encourage crime. Electricity, if it can be made available to produce instant and painless death, will be a favorite agent for self-murder.

* A physical, not a mathematical consequence.

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It is reported from Washington that the United States Supreme Court has reached a decision in the great telephone case. The opinion has been prepared, and would probably have been read last Tuesday, had it not been that the court adjourned as soon as Chief Justice Waite announced the death of Justice Woods. As it is, the opinion in this case will be read next week. Lawyers who have followed the case closely predict that the decision will be generally in favor of the American Bell Telephone Company; but some of them add that, while it will be technically favorable to the Bell Company, it will carefully limit the privileges of that company to the actual terms of its patents.

The Sprague Motor Company has contracted with the C. B. & Q. R. R. Co. to furnish motors for the railroad transfer tables at Aurora, Ill. This is a new use for electric motors, and will undoubtedly develop very rapidly. There is no more enterprising class of men than practical railroad managers, and when once convinced of the efficiency and economy of the apparatus presented, do not hesitate to adopt it.

The currents employed in the medical applications of electricity seldom exceed 30 amperes. For such purposes a galvanometer should be accurate, sensitive, and perfectly dead beat. Changes in magnetic intensity give rise to considerable error, if the instruments are not adjusted for each place. A galvanometer of a capacity of 30 amperes reading to tenths of an ampere and independent of the earth's magnetism is much to be desired.

In the history of electricity no single year commenced with such promise of development in all material electrical work as did the present. Before its close we think there will have appeared abundant proof of the fulfillment of this promise. Economical long distance incandescent lighting, storage of electricity and electric locomotion are three interesting and leading branches of electrical work that are apparently to be practically and commercially solved, if not already. The REVIEW will faithfully chronicle all progress, and will continue the leading exponent of honest electrical thought and work. Those meretricious elements of stock-raising and selling on so-called inventions of imaginary value, which have in a few instances crept into the electrical business to take advantage of the public ignorance of the power and extent of electricity, will always receive in these columns the airing that such schemes deserve. Honest effort in electrical work is sure to bring forth excellent results, and such is ever worthy of commendation.

Many arguments have been submitted to the committee of the Massachusetts Legislature in opposition to the bill granting gas companies the right to furnish electric light. In many places they will not avail themselves of the privilege, unless there is a prospect of an outside corporation taking up the business. In extending the use of gas for heating and cooking, and of automatic means of lighting and extinguishing the same, they have in the East done very little. In the Western States, the consumption of gas in places has been well nigh doubled by active efforts on the part of the local companies to educate the community to the possibilities of gas for heating and cooking. Families cannot afford to use coal for cooking, at least during the summer season, if gas can be obtained. The undue conservatism displayed in this matter leads one to infer that they will not be active in introducing electric lighting wherever the demand for light can be filled, though imperfectly, with gas.

In a town in Massachusetts a local company put in operation an electric light plant to light the streets of the town. For certain reasons, possibly existing in the minds only of a few citizens, a movement was made to give the contract for lighting to a new company to be formed, or to a company in a neighboring town. In the meantime a committee on the part of the town, of which one was a selectman, called on an agent of an electric light company, but not the one which supplied the plant then in use. The agent advised the committee that it would not be fair to enter the field now occupied by another company; that the business was enough for one company but not for two, and advised them to renew the contract with the existing company. Such manly conduct was much commented upon and the old company received the contract for the new year. To have advised and pushed the organizaion of a second corporation would have benefited the agent to the extent of a commission, but to the detriment of electric lighting in general.

LET ELECTRICAL WORK IN COLLEGES BE THOROUGH.

The number of fourth rate colleges and universities is large and constantly increasing. There are, of course, men in these institutions who work hard for little pay and with benefit to their students. It is not uncommon to find the physical department managed by one who has not made a specialty of the study of physical science, the apparatus composed in the main of pieces illustrating the wonders of frictional electricity.

Oftentimes this subject is finished before an experiment is performed, then some day after school, pupils and instructor remain, the time-honored frictional machine, pistol, collapsable house, chime of bells, etc., are brought from the cases. The teacher, for the time being, at least, is looked upon as one in league with the rulers of the black art, and his influence correspondingly increased. Amazement not instruction, is in general imparted. The text-book used is twenty years behind the science of the day He makes light of more recent progress and harps on fundamental principles (many in the light of recent researches superseded). An induction coil is to him a wonderful instrument, because it gives shocks, or, like its competitor, the plate machine, rivals the thunderbolts of Jove. A battery is the only convenient source of electricity. He employs the older forms and does not describe recent improvements. He calls galvanoscopes galvanometers and knows little of the methods of electrical measurement.

TELEPHONE PATENTS IN CANADA.

The Canada people some time ago undertook to throw the Bell Company out of local existence, under the patent law of that enlightened government, which requires patentees to manufacture within the dominion, all instruments or parts of instruments used there. Like all the moves against the Bell Company, it was a sort of hooked finger process to get something for nothing out of a blarsted Yankee, you know.

Application was made by Wright & Hibbard, of Montreal, to have the government cancel the patents controlled by the Bell Company in Canada, on the claim that the five years limit had been excelled, and the company was still importing its instruments. In defense the company showed that the patents of five years ago are covered by more recent patents, and the time under the statute for manufacturing these has not yet arrived. The Minister of Agriculture on the evidence presented, dismissed the case on the 7th instant, and thus confirmed the validity of the Bell Company's claim in Canada.

A WORLD'S FAIR IN 1890.

The *Evening Sun* proposes that "there should be held in this city of New York in the year of grace eighteen hundred and ninety, a World's Fair and Exhibition of united industry, the greatest ever known. * * * Let the Government bestow its authority and sanction and contribute of its resources; and let New York lend its Central Park for the occasion. No place so fit for so great an enterprise, and let there be genius and millions to carry it to an issue."

This happy idea we most heartily second. In no industrial or scientific field will there be more to mark the century's progress than that which the various branches of electrical work can present, and such an exhibition, as so felicitously proposed by the *Sun*, would, under broad-gauged management, receive the instant co-operation and patronage of the vast electrical interests which have sprung like magic to the front ranks of commercial activity during the past decade. By all means, let's have a World's Fair in '90, and in Central Park.

To make platinum adhere firmly to gold by soldering, it is necessary that a small quantity of fine or 18-carat gold be sweated into the surface of the platinum at a white heat, so that the gold shall soak into the surface of the platinum; ordinary solder will then adhere firmly to the face.

Herr H. Kessler, of Oberlahnstein, has brought out a magnetic separator to be used for ores, turnings and filings, and for ground slag, a different modification being employed for each of these materials. The separator consists, as usual, of a magnetized iron drum which receives slow rotary motion, whilst the stuff from which the iron is to be separated is passed over it either from a vibrating hopper or by means of a conveyor. The separator for ore will treat stuff up to .2 of an inch in the grain, and that for Thomas slag will treat stuff varying from .04 to .16 of an inch. When treating ores and heavy materials, six tons can be passed per hour.

A western telephone company, in building an "extra-territorial" through line between Kansas City and St. Joseph, Mo., was petitioned to make a certain point a station on the line. The petitioners, first mentioning that the town's location was less than a mile off of the line laid out by the company, gave a list of the business enterprises, chief of which were two churches, a school house, an apiary, a blacksmith shop and good country roads. A brief wrestle with the problem presented, resulted in the company reaching the conclusion that there would not be much toll business in country roads and a school.

A method of connections used in the Reynier accumulators of the Plante type is novel. Each plate is attached on the upper section to a copper clasp. Two narrow channels are made on opposite sides of the lid. Into one of these the positive clasps are placed, into the other the negative clasps. Mercury is now poured into the channels, connecting thereby all the plates of same polarity. The plates can be packed and transported separately, a method convenient and economical. Setting up and taking apart the cells, as no solder is used, does not require an expert. If after long use a plate becomes imperfect, it can be easily replaced by one who is not an electrician.

The chapel at Madrid, where, previous to interment the bodies of deceased persons are temporarily placed, has recently been fitted up with an electric attachment which is to prevent living interments.

The apparatus is five centimeters in height and three in diameter, cylindrical in shape, and composed of a double tube, at the summit of which a copper disk is delicately balanced. With the least possible motion of the body upon which it is placed, the disk falls, establishing contact with the terminals of the circuit, and rings a bell in the apartments of the guardian of the chapel. The inventor of this particular form of alarm is Mr. Estelat, who has in all his experiments thoroughly convinced his audiences of the perfection of his system, and the thoroughness of its action.

"How may I become posted in electricity?" is an oft asked question. Few people know how to study. They attempt too little or too much. A resolution made to read a book on electricity, they compute: "400 pages—I'll read ten pages every evening and finish the subject in six or seven weeks." Can they expect to do alone what students in the best technical schools under able instruction and assisted by the conversation and interest of fellow students fail to accomplish in less than two years? The success of instruction by correspondence depends largely on the fact that a lesson of suitable length is learned before a second is taken up. A text-book to be reasonably compact is shorn of many interesting and instructive facts, which, though they may have no educational value in themselves, are of use in that they hold the attention of the reader and fix in the memory important facts and principles. The electrical journals contain articles that may easily be read entire at one sitting, and as each succeeding number will have still other articles on the same subjects as those of previous issues, the various principles in this way may be reviewed and re-reviewed and with no effort on the part of the reader. In no way can a knowledge of a subject be gained so easily as by regularly reading a journal relating to that subject.

OUR CHICAGO LETTER.

(From a Special Correspondent of the ELECTRICAL REVIEW.)

La Salle street from Randolph south is in as complete a condition of confusion confounded as it is well possible to conceive. The occasion is the placing of the street railway cable conduit from the north side. The franchise of the cable road gives the La Salle street tunnel to the road, and allows a loop through La Salle and Dearborn.

In La Salle there were, in addition to the usual gas, water, and sewage pipes, no less than seven different systems of wire conduits, pipes, boxes, etc., with every sized wire from a number eighteen to a number four.

The railway company, like a destroying angel or an earthquake, has gone plowing down the street, and in doing so has struck two lines of conduit of the Dorsett pattern, cast up to surface the debris of three or four manholes, and hardly no end of pipes.

It is almost impossible to relay these properly for want of room, so the city and the telephone company where these disturbances have occurred are replacing the conduit by two and three inch iron pipes, into which okonite or kerite wires will be drawn; and by laying these alongside of each other less valuable space will be required to accommodate them.

Pittsburg has fallen into line as a "Police Telephone and Signal Company" protected town. The council passed the requisite act on the 9th, and the contract was signed, which calls for 9 central offices with 90 stations. All the latest improvements and best appliances are called for, and the plant is to be a model one in every respect.

The Missouri and Kansas Telephone Company has just completed a No. 9 B. & S. hard drawn copper wire line from Kansas City to St. Joseph. The distance is sixty miles, and there are thirty-five poles to the mile. The total resistance of the line, including a steel wire section spanning the river is 316 ohms. The route was carefully selected with reference to proximity of other wires, and as a result the line is almost entirely free from induction troubles, and is rendering most excellent service.

The M. & K. Company gained 157 subscribers in April, and of these 77 were additions to the Kansas City exchange list.

The Chicago Arc Light and Power Company has purchased the Wunder & Abbott Illuminating Company's plants, and is reaching for "a few more left of the same sort." For the present it will use the central stations now in use, but it is the intention eventually to build complete and convenient stations on each of the three sides of the three-part city, and concentrate everything at these three centers.

The telephone muddle is gradually becoming more and more uncomfortable. The regulators at Springfield are pulling at it, and the city regulators are tugging at it also. There was a very comical side to the matter made evident the other day, which was alluded to in this column, but which, owing to some misunderstanding between the types and the manuscript, failed to materialize in print. It was this: The papers here have been egging on the legislators to bear down as hard as possible on the telephone people, and thus reduce the rentals. So far, so good, but there is such a thing as overdoing a good thing. One morning these advocates of the pan electric, and forty other institutions of a similar character, waked up to see that the cake was liable to burn in the baking. A new amendment to the Baker bill fixed the rental direct at $12 per year, but each connection was required to pay a small sum The newspaper mathematicians figured the grand total as they came down on the street car that morning, and their eyes opened to the fact that if that amendment went through the several journals would pay $1,000 to $1,500 per annum for their telephones, in place of $125.

There was an immediate hush, a silence that could almost be felt, all along the line. The most blatant was as quiet as a nurse at the bedside of a sleeping patient The original snuff taker omitted the pinch, and the little people neglected the daily sneeze, until after the amendment was killed, when the "swear off" was declared abrogated, and the papers went at it again as before.

The last phase of the bill is a yearly rental of $36, with a toll system, which under no circumstances must be allowed to exceed $6 per month. A notice to the Secretary of State must fully explain the system under which the company purposes doing its work. The bill has gone to its third reading.

That for the State. In the city there is a bill before the council which contemplates a license fee of $25 for each instrument. This proposed ordinance was referred to the Committee on Licenses, before whom it was discussed at length. The result of the matter was that the ordinance will be recommended to the council for adoption. The revenue to the city under an act of this nature would be not less that $75,000 to $100,000 per annum.

A meeting of the Western Gas Association at St. Louis was made interesting by the discussion of the electric lighting question, apropos of its antagonism to gas illumination. The sentiment was largely in favor of combining the two under the wing of the gas monopolies. Preaching and practice are working well in double harness now.

The St. Louis Western Electric Light Company has just started a central plant at the corner of Franklin avenue and Collins street for commercial lighting. The company starts off with 70 lamps.

East Toledo, Ohio, is now lighted by a temporary plant, awaiting the completion of a first-class plant now nearly ready for business. The building will cover 42×80 feet with a boiler house detached. The engine room will have capacity for four 150 horse power engines. Two of these are now going in, and the foundations for the others are being laid. The plant will probably be in operation by the first proximo, and is owned by the W. E. Light and Power Company of Toledo, whose place of business is so close to the works of the gas company.

These two plants, as their names indicate, have adopted the Western Electric Company's system. At the latter plant there will be six 35 light machines used.

Mr. C. M. Barclay, manager of the Western agency of the Sprague Electric Railway and Motor Company, will be pleased to see his friends at 185 and 187 Dearborn street, where he has located with his brother, the well known wire fellow, J. L. B, who manages the affairs of Holmes, Booth & Hayden, hereaway.

The simultaneous renewal of the rumors of a live volcano in Arizona, and the reception of an invitation to hear Dr. Moses on earthquakes at the monthly meeting of the Electric Club, induces a cold, shuddering like sensation, and almost makes a fellow feel that he wishes his father had joined the Shakers, while yet a gay young bachelor.

ERRATA.

In the article on carrying capacity of wires, page 8, May 7, in table one, "up to 50 lamps" should read "up to 50 amperes." The word lamps belongs to the preceding line.

The Chicago correspondent of the REVIEW wears a watch charm on which the mystic letters $C = \frac{E}{R}$ are displayed. To many of the dynamo electricians this combination has proved a profound mystery, but at last the seal is broken. One of these gentlemen has discovered that C. E. R. means "correspondent of the ELECTRICAL REVIEW."

CHICAGO, May 16, 1887.

OUR BOSTON LETTER.

(From a special correspondent of the ELECTRICAL REVIEW.)

The West End Street Railway Company came up resolutely last week before the Committee on Street Railways and asked that their petitions for rights to tunnel Beacon Hill, and lay tracks in the Tremont street and Boylston street malls, be granted. Hon. Lorius M. Child argued that tunnels were impracticable, and that the use of the malls was necessary to keep the tracks off of Beacon street. Hon. Moody Merrill, for the Consolidated road, said that the tracks on the common were necessary, even if the tunnels were built. Mr. Hyde said that his company proposed to begin, first the construction of a tunnel from the corner of Cambridge and Charles streets to a central station; a second would connect the Northern depots with this station. The Mount Vernon street tunnel would next be built, the Beacon street one being given up. Lastly, the central station would be connected with Park square..

The town of Hyde Park appropriated $4,000 for arc lights on the principal streets. The selectmen have inspected many electric light plants in their vicinity, and are in a position to make an intelligent selection of a plant suitable for their town. A like plan is often pursued by the business clubs formed in New England States. During the winter a committee is appointed to examine electric installations and report. A company is then formed, and the light introduced.

Extensive improvements are in progress on the water front of Marblehead, and also at the "Neck." There is a strong desire on the part of the townspeople and summer visitors to have the main streets lighted by electricity. The Marblehead Gas and Electric Light Company, as is the title under their charter amended by the Legislature last year, are prepared to establish an electric plant, as soon as a sufficient demand is shown for the light.

The recitations of the seniors of the Institute of Technology have been discontinued. The whole time up to the final examinations is spent on the completion of theses. These are in general of a practical nature, and in many cases the practice in preparation is no less beneficial to the student than the results are useful to the world.

1,300 battery cells are required by the Fire Department. The number could be much reduced, if nothing but silent alarms were given. Ten or twelve miles from the city, if the wind blows from that direction, the fire bells are heard striking almost every hour in the day. At one time a doleful steam foghorn was operated by the alarm circuit in Brighton; and for an overturned kerosene lamp, or a leaky gas main in the other end of the city, a large community were compelled to listen to the mournful toot, toot. It was too much. The attempt is made to put the street department on a permanent basis, to free the East Boston ferries, to build a new court house in ten years, but the fire alarm is managed on conservative principles. The Mayor has improved the condition of our streets to a point far beyond what has been accomplished in New York under the new administration, and it is confidently expected that he will take steps to secure the introduction of a still alarm.

The Boston Electric Light Company have begun the installation of motors on their series circuits for power. Cobb, Bates, & Yerxa in their Bowdoin square store, have in use one of the Baxter model, driving a coffee mill. It is to be attached also to a freight elevator and to be used for hoisting. The motor is successful as possessing constant speed under varying loads. A centrifugal governor in a small balance which throws more or less coils of the field into circuit as the load varies. The strength of the field increases or decreases with the load.

The Cambridge Gas Light Company arei making preparations to operatean arc and in r candescent system on the opening of the fallt season.

BOSTON, MASS., May 17th.

OUR ARKANSAS LETTER.

(From a Special Correspondent of the ELECTRICAL REVIEW.)

The manager of the telephone exchange from one of the towns east of us was in to see me a few days back, and among other things told of having been sent to replace some Pan telephones with Bell instruments, on a short private line. After getting them all in place he found the bells rang weak, and upon asking what kind of ground connections they had, was told, "The very best kind, a bottle filled with water and buried two feet deep." And that's exactly what they had, with the end of a wire stuck in it. They varied the thing a little by using a jug at one end. It is needless to state the jug and bottle were soon dispensed with, and the line made to work.

From all I can learn, there are a good many "Pan-Handle" telephones, as the natives call them, scattered through this State. In fact, a party interested in a rival, "much superior," etc., telephone, informed me he was selling lots of his instruments; that the "Bell patent was played out, and the woods were full of rival telephones;" that "the Bell Company could not, and would not do anything."

The Southern Telephone Company who are operating an exchange here and at Fort Smith, have been left alone and in operation so long, that they seem to be thoroughly convinced that the Bell does not intend to prosecute. Perhaps Messrs. Storrow and Dickerson may convince them otherwise. They have been quite successful in procuring subscribers, and now have upwards of 400 at $3 and $3.50 per month, a cut of 30 per cent. on the Erie Company's rate. They have not, however, been near so successful in their management, and the service given has been miserable in every way. They had to change their transmitters entirely and substitute a home made affair (an imitation of the Turnbull, I believe) for the "Long," with which they first started; and they are now making their third change in switchboards, and also moving the central office. They have had things pretty badly mixed for several weeks, and will not get straightened out for a month or two at their present rate of progress. There is a great deal of dissatisfaction among their patrons, and only their strong local interest and cheap rates enable them to hold on. Their local influence is immense, as people here seem to think that by supporting them against the Bell Company they are, in some way, helping "our Garland."

President J. W. Bennett, of the Erie Company, was here on the 8th and 9th of May. He has been making a visit through the southwestern territory of his company, under the guidance of Genl. Supt. J. K. Dunbar. They spent several weeks in Texas, a day or two at Hot Springs, and went from here to Fort Smith, in this State; from there for home. He was accompanied by his wife and little daughter, and all expressed themselves as well pleased with their trip and the different places they had seen, especially Little Rock.

I have just heard that another injunction was served on the Pan Electric Company at Dallas and Fort Worth, Texas, Saturday, May 7th. This closes up the lessees of the original Pan Electric plants at those places. The latter having been enjoined and closed by the U. S. Court in February last. This undoubtedly ends telephone competition in Texas for good, and if the Bell Company will now "do em 'up" here, we shall all be happy. RUHTRA.

LITTLE ROCK, ARK., May 11.

A telegram from Muncie, Indiana, dated the 7th, announces the closing of a contract for the construction of an electric street railway. Ex-Commissioner of Pensions, Col. W. W. Dudley, is the contracting party, and it is understood that electric lighting will follow in the train of the new departure.

Electric fire alarms are attracting attention n a great many of the smaller cities, and the ecent improvements of new companies in his field are such as to make the older ones realize that they must be up and doing or lose a very valuable part of the business.

⁂ The Western New York Telephone and Telegraph Company began operations last week with 20 instruments. This is the writing telegraph system.

⁂ Telephones are getting to be so numerous in Palatka that soon a regular exchange will have to be established. Those now using them find them indispensable, and great savers of time.

⁂ The general offices of the East Tennessee Telephone Company are to be moved from New York to Nashville. Mr. O. F. Noel, of the Cumberland Telephone Company, is the president.

⁂ The attempt to legislate against the telephone interests of Pennsylvania, made by some of the uninformed representatives of the people, has proven abortive, the proposed bill being defeated.

⁂ The Mexican Central Telegraph Company held its annual meeting in this city. The directors chosen for the ensuing year were George W. Ballow, Charles O. Moore, John W. Weed, John McGinty, and J. D. Sargent.

⁂ The New York Telephone Exchanges haven't fifty residence telephone subscribers out of the 7,000 on their books. A very different state of affairs exists in Brooklyn, Cincinnati, Chicago, Kansas City, and other places, but here telephones in residences don't seem to be popular.

⁂ In the telephone service the same qualities of wire are called for as in the telegraph service. Probably by far the largest share of the existing telephone lines in this country are constructed of No. 12 E. B. B. galvanized. No. 4 E. B. B. has replaced, on long lines, the wire of low conductivity, at the outset deemed "good enough for the telephone."

⁂ In a recent interview, General Superintendent Eckert, of the Metropolitan Telephone Company, spoke of the average of telephone calls as follows: "The average is between nine and ten times a day; but in some of our exchanges, in Pearl street, for instance, it is thirteen times a day. Of course, certain customers use the instrument much more than that. Some of the steamships and steamboat companies average over a hundred times a day, and some brokers almost as much."

⁂ Between 300 and 400 telephone poles have been erected by the Central New York Telephone Company, in Syracuse, N. Y., and the work is progressing rapidly. It is estimated that about 800 miles of wire will be necessary to cover the city. About forty men are engaged in the work, two gangs raising poles, one gang stringing wires, and a gang shaving the poles. Two men are also putting on the cross pieces. The poles run from between fifty to ninety-five feet. The poles will be erected, and the wires strung, in a couple of weeks.

⁂ It is certainly remarkable how little telephones are used in residences in New York, as compared with Chicago or Cincinnati. There the ladies do their marketing and sometimes their shopping, and the doctors much of their prescribing and consulting by telephone. Here the instrument is not used socially at all. In all other ways, at least, New York is in the van of telephone progress. In quickness of service and accuracy; in the use of the latest improvements; in the extent of wires placed underground; in the number of users of the telephone, she is in the front rank.

⁂ Prof. Trowbridge's plan of submarine telephony, in which speech was to be transmitted between vessels at sea without the aid of any connecting wire, has been abandoned as impracticable, as the system upon which Mr. Edison has been experimenting in Florida is more promising of good results. In this system the telephone signals by long and short explosive sounds, instead of by spoken words, and communications have been successfully exchanged through the water between vessels from three to four miles apart, with the prospect that the working limit may be increased with improvement in the apparatus.

⁂ In an action brought in New Jersey by the New York and New Jersey Telephone Company to recover for the rent and services (tolls) of a telephone, it appeared that the number of each service (toll) was entered at the time upon a slip and these slips were sent to the main office, where the gross number of calls for each month was entered in a book, and the slips were afterwards destroyed. Held that the book was not admissible as evidence. Decided February 17, 1887, by Supreme Court of New Jersey, reversing judgment of justice of the peace, affirmed by Court of Common Pleas. [6 Cent. Rep. 822].

The Limiting Distance of Speech by Telephone.*

The following table was accidently omitted from the last number of this journal. It summarizes a large number of experiments that have been made in different parts of the country, and on different lines, to determine by observation the connection that exists between speed of current, distance spoken through, resistance, and capacity.

Wire.	Route.		Length in Miles.	Total Resistance × Total Capacity	Speed of Current in Seconds.	Telephonic Notes.
Nos. 142 and 144, Denham and Atherstone.	New West Coast.	Open Cov'd	90 2.5	2247.0	0.0007 calculated.	Gower-Bell Telephone. Speaking good.
London and Denham	Underground		21	2963.5	0.0009 calculated.	Gower-Bell Telephone. Speaking good.
Nos. 142 and 144, Denham and Stafford	New West Coast.	Open Cov'd	119 5	4715.7	0.0015 calculated.	Gower-Bell Telephone. Speaking fairly good.
South Wales		Open Cov'd	72 1.25	5680.0	0.0016 calculated.	Gower-Bell Telephones, working satisfactorily.
Newcastle Telephone system, Warkworth to Stockton P. O.	Via Newcastle, Sunderland and West Hartlepool.	Open Cov'd	63.831 12.689	5817.6	0.0016 calculated.	Gower-Bell Telephones. 5 intermediate electromagnets of 1,000 ohms resistance, in derived circuit. Speaking satisfactory.
Nos. 142 and 144, London and Towcester	New West Coast.	Open Cov'd	50 21	7341.3	0.00234 calculated.	Gower-Bell Telephone. Speaking weak, but just able to hold a conversation.
Nos. 142 and 144, Denham and Nantwich.	New West Coast.	Open Cov'd	146 7	7612.1	0.0034 calculated.	Gower-Bell Telephone. Speaking weak, but just able to carry on a conversation.
London to Denham (with additional loop between Denham and Hanwell)	Underground		39	10221.0	0.0032 calculated.	Gower-Bell Telephone. Speaking good, but approaching the point of difficulty.
Nos. 142 and 144, Denham to Warrington	New West Coast.	Open Cov'd	172 8	10399.16	0.0038 calculated.	Only just able to speak. Impossible to carry on conversation.
Nos. 142 and 144, London to Atherstone	New West Coast.	Open Cov'd	90 23.5	12511.2	0.004 calculated.	Only just possible to speak.
New Irish Cable	Cable.	Open Cov'd	25 62.9	12587.4	0.00412 observed.	Berliner's Telephone. Only just able to talk.
Newcastle District.		Open Cov'd	30 30	12640.0	0.00412 calculated.	Requires very good telephones and very good voices.
Copper. London to Nevin (land lines for the new Irish Cable)	Via Worcester & Shrewsbury	Open Cov'd	251.18 18.5	15771.5	*0.0035 observed.	Berliner's Telephone. Some voices good.
No. 11, London Stock Exchange to Liverpool Stock Exchange (iron wire, No. 8 gauge)	Via London and N. W. Railway.	Open Cov'd	199.014 7.243	16417.8	0.005 observed.	Telephone not tried.

N. B.—All the open wires are iron except those marked copper; the speed is calculated from the formula $t = 32\times10^{-8}$ KR.

* The constant for copper is 22×10^{-8}.

The limiting distance through which it is possible to speak varies inversely with the speed of the current, and that the speed of the current varies inversely with the product of the total resistance and the total capacity of the circuit. Hence we can say that the number of reversals that it is possible to send through any circuit varies inversely with the product of the total resistance (R) and the total capacity (K), or the limiting distance

$$S = KR \times \text{constant} \qquad (1).$$

This is only another form of Thomson's law for $K=lk$, and $R=lr$, and

$$\therefore S = krl^2 \times \text{constant}.$$

It is seen that when the speed of the working current was

0.001″ speaking was perfect,
0.002″ speaking was good,
0.003″ speaking was fair,
0.004″ speaking was difficult.

If we put equation (1) into this form,

$$A = krx^2 \qquad (2)$$

and give to A the following values:

Copper (overhead).....15,000
Cables and underground.....12,000
Iron (overhead).....10,000

we can find the limiting distance we can speak with any wire; for

$$x^2 = A/kr.$$

Take copper, whose constant is 15,000, and a wire whose resistance 1 ω per mile, and capacity 0.0124 per mile, then—

$$x^2 = \frac{15.000}{0.0124}$$

$$x = 1{,}100 \text{ miles},$$

which is the limit of speaking upon such a wire.

This law has been arrived at independently by M. Vachy, of Paris, and by Dr. Wietlisbach, of Berne, and it has been verified on the German underground wires by Messrs. Felten & Guilleaume.

The difference between copper and iron is clearly due to self-induction, or to the electromagnetic inertia of the latter, and the difference between copper overground and copper underground is due to the facility that the leakage of insulators offers to the rapid discharge to earth at innumerable points, of the static charge, which in gutta-percha-covered wire can find an exit only at the ends.

W. H. Preece.

* This communication forms the appendix to Mr. Preece's remarks on Prof. S. P. Thompson's paper.

The American Temperature Regulating Company, at Chicago, capital stock $250,000, for the manufacture of mechanical appliances—incorporators, Abraham S. Kissell, David Kelley, and B. A. Brown—was granted license on the 29th by the Secretary of State.

⁂ A dispatch from Ottawa, Canada, says: "The famous suit of Wright against the Bell Telephone Company of Canada, for the cancellation of the Edison patents, owned by the latter, which would give the petitioner power to manufacture the commercial instrument in Canada, was dismissed this morning, by Commissioner of Patents Carling, who gave judgment to the effect that, according to the statement accepted as the true position by both companies, the commercial instrument, as manufactured by the defendant, does not embody any of the elements or claims of the three Edison patents impeached; and, being of the opinion that the weight of evidence was in favor of that view, he thought that the importation of the commercial instrument was not an importation of any of the Edison inventions."

⁂ Some of the most remarkable of recent inventions are now rapidly introduced into the depths of Africa. The plant is preparing for a long distance telephone line along the Congo. The natives are noted for garrulity, and ought to become good patrons of an invention that so greatly enlarges the opportunities for gossip. Bishop Taylor's steamboat has by this time nearly reached the Congo, and with it the electric light will make its advent on the river, turning night into day wherever it goes. Stanley carries a Maxim repeating gun to encourage a respectful and inoffensive demeanor on the part of any ill-tempered people he may meet. De Brazza has high hopes that his portable bridges will enable him to rise superior to treacherous fords or clumsy ferries. All these things will painfully befuddle the native medicine men, who make amusing attempts to explain to their people with what special magic each new wonder the white man introduces is endowed.

Getting Dog Talk Through the Telephone.

Mr. John F. Kerr, in the Recorder's Court at Paterson, had some difficulty in helping his client, Patrick Connors, to raise the fine of $4.68 imposed for saying "Bow-wow-wow" to John Brown, and thus inciting him to a disturbance of the peace. Connors told the lawyer that the money was due to him at the shop, and he gave Mr. Kerr an order for it. Before paying the fine out of his own pocket, Mr. Kerr concluded to telephone to the shop and see if the order would be honored. The following is Mr. Kerr's end of the telephonic conversation:

"Hello, Central! Give me No. ——." (Pause.)

"Is that ——'s shop?" (Pause.)

"You have a man named Patrick Connors working for you?" (Pause.)

"Connors?" (Pause.)

"Yes—Patrick Connors." (Pause.)

"Patrick." (Pause.)

"Well, he's been fined $4.68 for ——." (Pause.)

"Four dollars and sixty-eight ——." (Pause.)

"He's been fined for saying Bow-wow-wow." (Pause.)

"Bow-wow-wow." (Pause.)

"Bow." (Pause.)

"No, no. Bow-wow-wow." (Pause.)

"Yes." (Pause.)

"Yes; bow-wow-wow—like a dog." (Pause.)

"Bark. Bow-wow." (Pause.)

"Yes, that's it. Bow-wow-wow." (Pause.)

"John Brown." (Pause.)

"Brown." (Pause.)

"John." (Pause.)

"That's it. He's been fined. Will you pay the ——?"

"Is his word good for $4 68?" (Pause.)

"Four-sixty-eight." (Pause.)

"Four-dollars-and-sixty-eight-cents." (Pause.)

"No, four." (Pause.)

"Sixty-eight." (Pause.)

"Yes; four-sixty-eight." (Pause.)

"Yes." (Pause.)

"Yes." (Pause.)

"Yes." (Pause.)

"All right. Good-by."

Mr. Kerr hung up the earphone, took a long breath, and then paid his client's fine out of his own pocket.

Underground Telephone Work in Brooklyn.

The passage of the Subway bill by both branches of the New York legislature assured a continuance of the present Commissioners in Brooklyn for two years from the first of November, 1887. This will encourage the electrical companies of that city to proceed with their underground work as arranged for with the Commission in the past. In an interview with General Manager W. D. Sargent of the telephone company, a REVIEW representative was informed that plans had been submitted and approved by the Commissioners for six miles of conduit to be laid during the coming season. This work will be commenced early in June. The plans embrace continuations and extensions to the system already laid of creosoted wood. There are thirteen miles of telephone and telegraph conduits in the city.

Mr. Sargent states that no defects have developed in the use of the creosoted wood, the first sections of which have now been underground for three years, with no signs of decay. This result confirms the belief of the Subway Commissioners and the telephone officials that creosoted wood is among the best of any of the materials suggested up to the present time, and can certainly be laid economically.

Inspecting the Telemeter System.

An invitation from President Erastus Wiman, of the Telemeter Company, was sent to the American Institute of Electrical Engineers and to several other electrical gentlemen of New York, to inspect this system in the warehouses of the Brooklyn Bridge Freezing and Cold Storage Company, Franklin Square, this city. A number of gentlemen accepted, and saw about forty tele-thermometers in the warehouses, indicating and recording the temperature of the different rooms and vaults. These instruments were pronounced by officers of the storage company to be an indispensable adjunct to the business, as in the storage of various merchandise it is imperatively necessary in many instances that the temperature remain the same at all hours. The visit was greatly enjoyed, and at its termination a collation was partaken of with the usual zest of electrical appetites.

Dr. Conrad Pabst Battery.

The positive plate is a block of iron ; the negative, carbon, with which is incorporated oxide of zinc; the exciting liquid of chloride of zinc. The cell gives 1 to 1.2 volts and has a resistance of .8 to 1.2 ohms with slight variation while supplying current. The iron pole lasts from two to ten years. By the absorption of oxygen from the air, the depolarizing qualities of the negative plate are continually renewed.

Official Requisitions.

The following are among the official requisitions for telegraph wire.

Belgian: "Iron wire of first quality, even running, without flaws or faults; well galvanized."

Prussian: "To be subjected to twenty rectangular bends without breaking, and wound in a helical coil several times round a wire of its own size, without splitting or breaking."

French: "Annealed charcoal wire, capable of bending at right angles to itself, in a vise, first one way and then the other, four times without breaking, and must stand wrapping round itself."

English Postal Telegraph: "Highly annealed, and very soft and pliable; free from scales, splits and inequalities. No deviation greater than .003 inch either way from prescribed diameter; well galvanized."

Western Union Telegraph Company: "Iron wire, to be soft and pliable, capable of bearing at least 2.5 its weight in pounds per mile; well galvanized."

* * The Lindell Railway Company, of St. Louis, has decided to use the Sprague motor in connection with storage batteries on their line.

The Messenger Boys Preferred to Work.

In these days of strikes and unlawful combinations of the horny handed against the oppression of capital, it is the duty of the faithful chronicler to record these—at least the more extensive of them, that much abused capital may, as far as possible, be prepared when history repeats itself in the future.

As is pretty generally known, a certain force is required for night duty at a large telegraph station. This is true of Chicago. In one department of this unpleasant duty Mr. J. H. Ray, a firm but gentle manager, has sole charge. His department is that of night delivery, and under his thumb are something like one thousand pounds of messenger—divided into chunks of eighty to one hundred pounds, in a lump. The thousand pounds struck the other night, because of some misunderstanding about Sunday work.

Mr. Ray, with that Napoleonic far-sightedness which is the prerogative alike of the successful military chieftain and the winner at poker, grasped the situation with both hands, and mashed the formidable conspiracy at one fell swoop. The thousand pounds of messenger was notified that at any time on a week's notice it, or any of it, could cease Sunday work.

In sixty minutes from the incipiency of the outbreak all was quiet, the night delivery was proceeding in its usual sleepy unobstrusive way, and the unconscious stock and bondholders of the Great Western Union will never know—save those who read the REVIEW—how thin was the partition which intervened between their financial lives and a grand monetary crash, if not a possible "dull, sickening thud."

Two significant facts occurring at about the same time, show how much there may have been lurking in the background. Within twenty-four hours D. H. Bates, Esq., of the Baltimore and Ohio lines, suddenly appeared here, and almost immediately Superintendent Geo. M. Meyers of the Pacific Mutual swooped down upon us.

It is agonizing to contemplate what might have been but for the prompt decision and percussion cap action of Night Manager Ray.

The Electro-Harmonic Society.

The first smoking concert of this newly formed society took place on the evening of Friday last in the banquet room of St. James' hall restaurant, Mr. C. E. Spagnoletti presiding. As many of our readers are aware, the society has been promoted with the object of occasionally bringing together the electrical fraternity and their friends for the purpose of enjoying social intercourse, unencumbered by the trammels of business, and to listen to good music, which hath charms to soothe the savage breast (not an unusual possession in these days of keen competition), discoursed by exponents of proved ability ; and, if a correct judgment can be pronounced from the impressions gathered on the opening night, we think that a long-felt want has been supplied A capital programme had been provided by the musical directors, and the Electro-Harmonic Society listened with evident pleasure to several songs and glees, performed in an admirable manner by Messrs. Dalzell, Kift, Bevan and Brown. Mr. Wilhelm Ganz, whose name alone went far towards ensuring success, most kindly placed his valuable services at the disposal of the society, and played the "Sonata Pathétique" of Beethoven, in addition to some lighter selections. During the interval, Mr. Spagnoletti, who has been untiring in his efforts in support of the society, explained briefly the objects which had brought the members together, and shortly before 10.30 the concert came to a close, amidst general expressions of satisfaction from the assembly.—*London Electrical Review.*

* * The Mansfield Electric Street Railway Company, Mansfield, Ohio, has been incorporated. Capital stock, $75,000. M. Van Rensselear and others, incorporators.

The Adventure of Telegraph Men with Hornets.

I hate to tell tales out of school, writes Henry Guy Carleton; but if Gen. Greely doesn't tone down his ideas of spring a little, I will narrate an incident of his brief career in Texas. He came down there in November, 1875, to build a telegraph line to San Antonio from Fort Brown. He had an insulator, which he and other experts had got up in Washington, especially for this line. It consisted simply of a well-lacquered sheet-iron cap over a dry wood screw, and had the general appearance of a tomato can on the end of a broomstick when in position. Well, the line was built—400 miles of it—and for two weeks or a month it worked like a dream. Suddenly warm weather came along, and when warm weather strikes the lower Rio Grande, it takes hold for keeps. The thermometer crawled up to 100, and after several weeks of this spell the line began to get mysterious kinks in it. There was trouble somewhere, and plenty of it. The line wasn't down; but it seemed to have lost its grip on through messages. San Antonio had to do its business with Fort Brown by relaying at Laredo. In a few days Laredo could only telegraph as far as Ringgold Barracks, south, or to Fort Clarke, north; and through messages from San Antonio to Fort Brown had to stop off three times en route and take a rest. At the end of a week the trouble was worse yet. Lieut. Greely—he was plain lieutenant then—sent couriers galloping up and down the whole circuit. They couldn't find a place where the wire was down or in contact with trees or anything. But they reported something queer with the insulators. Lieut. Greely was wild with indignant surprise. The idea of an "insulator" going wrong which had been concocted in Washington especially for Texas! Still the telegraph line wasn't working any better as a telegraph line than as a fish-line or a clothes-line; so he borrowed a mule from the quartermaster, and started out to investigate. He came back in light marching order that evening, with a sad secret in his heart and several inflamed lumps on his countenance, and minus the wayward army mule. The simple truth was that the Texan hornets, who are shiftless and lazy beasts, thought the new insulators were a shelter kindly provided by Government for their especial use, and had gone to work and filled every blessed one of them from San Antonio down with mud, sour honey and general cussedness, and the line was literally 400 miles of Hades in active eruption. Lieut. Greely wrote on to the Washington experts, who promptly got a new breed of insulators, solid as a brick, and burglar proof. These were shipped, and Lieut. Greely induced a gang of innocent and unsuspecting linemen to sign a cast-iron contract to take the old insulators down.

The "repairing" party left Fort Brown on April 10. By this time the hornets had raised an uproarious family in each insulator, and the first lineman who shinned up to serve a writ of ejectment got a dose of trouble which made his hair curl. The way those hornets expressed their opinion of Signal-Service hospitality was sinful. It cost the contractor forty-six able-bodied linemen, nineteen barrels of bread poultice, and a case of refined arnica, to "repair" the first eight miles of that line, and then operations ceased. When the linemen got so they could see well enough out of one eye to shoot, they went gunning for Lieut. Greely; but he had already fled the State in a blue fog, and the next I heard of him he had barricaded himself somewhere in the neighborhood of the North Pole. The line remained in an active and warlike *statu quo* until winter, and telegrams were forwarded by the aid of a slow, but persevering mule. After the first blizzard had calmed the hornets down a little and frozen the families into solid lumps, the contractor resumed his labors, and recouped his losses by shipping the insulators to Baltimore for canning clams, and sent seven dozen crates of assorted stings to England for sale as sewing-machine needles.

Now, I am a peace-loving citizen, and I do not wish to imbrue my hand in a brigadier's blood without just cause; but if Gen. Greely cooks up any more such walrus climate for this latitude as he gave us last week, just as I am on the eve of a fishing trip, I will send marked copies of the above story to those still capering linemen in sunny Texas, and within a week there will be an important vacancy in the Signal Office.

TELEGRAPHIC

.... A letter has just been disentombed in Pompeii, just where the district messenger boy lost it 300,000 years ago. The boy is supposed to be still alive, and slowly wandering along in the direction of the house at which the letter was to be delivered.—*R. J. Burdette.*

.... Some one raised the question of the possibility of working a key with the left hand and writing a letter with the right hand. An old operator said it was not possible that those working much at receiving press dispatches could receive and carry on a conversation at the same time. Some claimed that the average man could not write more than twenty words a minute, and to settle the question, tests were made of business men in the habit of writing but a few letters per day. The average speed was nearly forty words per minute.

.... The Phelps system of telegraphing from moving trains is in use on several trains on the New Jersey Division of the Lehigh Valley Railroad. The equipment consists of an insulated wire laid along the track, underneath the head of one of the rails. A number of wires are placed in the form of a coil around the baggage car, and messages are sent between this coil and the track wire, a distance of five or six feet, by means of induction. Regular Western Union rates are charged, with ten cents additional for train service.

.... A dispatch from Halifax says: Supt. Fisher, of the French Cable Company, arrived to-day from New York, and is arranging for the immediate construction of land lines connecting their cable at Sydney with Montreal, so as to give Canada a cable service independent of the United States. This land line will tap all leading cities and towns between Sydney and Montreal, where it will give the French cable connection with the Canada Pacific Telegraph system; also an additional connection with New York, by way of the Baltimore and Ohio lines. Mr. Fisher says the competition of the French Cable Company will make it exceedingly lively for the "cable pool."

.... Two of the guests at Mr. Andrew Carnegie's wedding last Friday night were telegraph boys out in Pittsburgh with him forty years ago. They were Robert Pitcairn, the Superintendent of the Pennsylvania's western division, and a man of wealth, and David McCargo, who is now the general manager of the Allegheny Valley Railroad. All three served in the old Atlantic and Ohio Telegraph office in Pittsburgh—the first ever established there—and did the entire messenger work of the place. Andrew Carnegie and his brother Tom, who was about nine years his junior, then lived across the river in Allegheny City, where they supported their widowed mother as best they could. Each of these old-time messenger boys has since grown rich.

.... Cadmium remarked the other day: "One would suppose from the Boston *News* that all the thunder-storms occurred in other sections of the country. No, I'm not afraid of them; but I can tell when one is coming. Years ago, just after I had gone to bed, a bolt struck the house, and tumbled down on my bed so much plastering that I could hardly get out. It did not wake up a person in the house. I can predict since that time thunder-storms, and make a record of 100 per cent. You, perhaps, have heard that you are perfectly safe when inside a mass of metal, such as a boiler. That may save one from getting struck; but I have been inside of a boiler repairing, and had the same feeling predicting a thunder-storm, which turned out to be the biggest of the season."

GENERAL BUSINESS NOTES.

Messrs. Cheney and Powers, of Troy, N Y., have taken the agency in their territory for the Baxter Motor, and are greatly pleased with its work.

Mr. F. S. Terry, Chicago, manager Electrical Supply Company, heartily endorses the proposed wire gauge reform of the National Electric Light Association.

S. B. Richards, the general agent of the Solar Carbon Company, reports a very lively trade in carbons. A number of large companies are sending orders to the Solar Company quite enthusiastically.

Messrs. Hazazer & Stanley, of 32 and 34 Frankfort street, New York, have mailed to customers a catalogue of their annunciators, electric bells, and the numerous other electrical appliances manufactured by them.

Prof. Culp's electric gas lighter, which is controlled by the New York Electric Brush and Ozone Company, is a simple and effective gas lighter that is meeting with popular favor. The price of the lighter is such as to bring it into very general use.

Mr. Daniel W. Baker, the large platinum dealer and refiner of Newark, N. J., and his wife, sailed for Europe on the Adriatic last Wednesday, May 11th. A large party of friends saw them off and loaded their cabin with flowers. Mr. and Mrs. Baker will be abroad three months.

E. D. Libby, of Boston, proprietor of the New England Glass Works, was in New York last week. In the manufacture of electric light globes his company does a very extensive business, and was one of the first to see the great future of electric lighting and the consequent demand for first class globes.

At a recent meeting of the Boston Scientific Society, A. V. Garratt presented an elaborate paper upon electrical dynamos. He traced the history of the invention and discovery in the line of electrical phenomena from 1813. The lecturer was attentively listened to by a greatly interested and edified audience.

The Partz Battery Company, of Philadelphia, are greatly pleased over a test made of their new primary battery in connection with motor work. Two cells used with a C. & C motor run a sewing machine for 19 hours—9 one day and 10 the next—with but one charging. The battery was then recharged, and when seen by a REVIEW representative one day last week was merrily running the sewing machine on its second term.

Messrs. L. C. Kinsey and H. R. Rhoads, of Williamsport, were New York visitors—looking into the storage battery business. The company of Messrs. L. C. Kinsey & Co. has been formed at Williamsport and will represent the Electrical Accumulator of New York for the State of Pennsylvania, excepting Philadelphia. They have just closed a contract at Watsontown, Pa., a place of 2,500 inhabitants, for a central station storage battery plant, of 500 lights, and have also contracted for a large central station at Phillipsburgh. These gentlemen have a big field and will rapidly develop it.

The new chimney of the Edison Illuminating Company, at Brockton, has been completed by the Jarvis Engineering Company, to whom the contract was awarded, and is quite an imposing structure, 110 feet high, having a core of 76 inches at base and 84 inches at top. This chimney will easily carry 1,000 horse power and is by far the largest in Brockton. The extensive alterations in that station have been made under supervision of Mr. J. H. Vail, general superintendent of the Edison Company, and who also has formed a combination of the arc and incandescent companies into one company which must effect a large reduction in the running expenses.

The Best Talent Seeks the Electrical Field

There have been added to the staff of the Sprague Motor Company recently a number of talented and energetic gentlemen destined to make their mark in electrical circles. O. T. Crosby, first lieutenant corps of engineers, U. S. A., lately stationed at New Orleans on river and harbor work, has resigned to join the motor company. Lieut. Crosby was one of the highest in his class at West Point and has since enjoyed an experience that will make him a valuable acquisition to the engineering department of the Sprague Company. Lieut. W. D. Greene, U. S. N., lately on duty on board the Atlanta, has resigned to assist Mr. Sprague in his mathematical work, a position which he is eminently qualified to fill. Mr. Frank Mansfield, who was one of the first to enter the electric power business, formerly in charge of the Daft Power Station, will in future occupy an important position in the railroad department of the Sprague Company. Mr. A. H. Chadbourne, son of the late Paul Chadbourne, president of Amherst College, is now manager of eastern Pennsylvania for the Sprague Company, with offices in Philadelphia, and has already won that success which proves his fitness for responsible work in this rapidly developing field.

* * The American Bell Telephone Company has instituted suit against the Egan Electric Company, of Columbus, Ohio, for infringing.

* * The Gratiot Electric Railway Company, Port Huron, Mich., has been incorporated. Capital stock, $250,000. Wm. F. Botsford, and others, incorporators.

* * Speaking of the failure of Messrs. Gilder and McArthur to reach the north pole by way of Hudson's Bay, the Edmonton *Bulletin* suggests, for the benefit of future explorers, that a much better route is by way of Edmonton and the Mackenzie river. There is now, it says, stage or steamboat communication almost all the way from Calgary to the mouth of the Mackenzie, on the Arctic Ocean, in latitude 70° north, and a traveler leaving Winnipeg in the early summer months could reach the latter point with all needful supplies after a comfortable journey of not more than two months Westward from the Mackenzie to Behring's Straits is the warmest portion of the Arctic coast and the part nearest the pole in America which can be reached without difficulty. Thence to the pole is about 1,400 miles, and the explorer must determine for himself how that portion of the distance is to be covered.

* * Professor Gould has found that telegraph wires on poles in the air conduct the waves with a velocity of from 14,000 to 16,000 miles a second, and the rapidity of transmission increases with the distance between the wire and the earth, or the height of support. Wires buried in the earth transmit slowly, like submarine cables. While wires at a slight elevation transmit signals with a velocity of 12,000 miles per second, those at a greater height give a velocity of from 16,000 to 24,000 miles. Wheatstone's experiments in 1833 claimed to show a speed of transmission of 288,000 miles per second, but this statement has never been sustained. Wheatstone used the Leyden jar with the highest tension and half a mile of resistance circuit. In 1869 the careful series of tests made over the Western Union line, using the circuit, Boston, Detroit, New York, and Buffalo, with battery currents of low tension, showed the following result:

Velocity per sec.	No. cells battery.	Length of circuit.	Velocity per sec.	No. cells battery.	Length of circuit.
10,200	70	400	29,450	295	400
20,000	160	400	18,200	295	1,000

A Method of Charging Secondary Batteries by Means of a Magneto-Electrical Machine, the Potential of Which is Much Lower Than That of the Cells Joined up in Series.

Mr. Smith, of Oxford, says that it is sometimes inconvenient to set up a dynamo and engine of considerable size for charging secondary batteries. As the following method by which only a small machine and motor is used has answered well for several years, it may perhaps be of use to others who, like myself, are engaged in physical work. A small water motor drives a small magneto Gramme machine, the same motor by means of wheel work, for reducing velocity, switches the machine on to one cell of the battery at a time; such being the case, the E.M.F. of the charging machine need only be a little in excess of that of each cell. The method of charging in parallel was tried, but it did not answer well, as a slight difference of internal resistance of the cells caused the current to be unevenly distributed amongst them. A somewhat similar method of switching in cells by clock work has of late been introduced into the chlorine battery of Mr. Upward. The idea of putting the current on to one cell at a time seems to be due to Poggendorff (if I remember right) *Electrical Magazine* for 1842. It may be mentioned for the benefit of those who use chlorine gas, that it can be readily produced in abundance by the electrolytes of hydrochloric acid (carbon electrodes being used, as platinum is acted on by the gas as it comes off). A small motor and electric machine effects this constantly in the laboratory.

The Electric Lighting of the Glasgow Underground Trains.

At the eleventh ordinary general meeting of the Glasgow Philosophical Society on the 13th inst., Mr. T. P. Carswell, C. E., of the North British Railway Company's Engineering staff, read a paper on "The Automatic Electric Lighting of Trains on the Underground Railway." The particulars given as to cost are interesting. The current generated by a dynamo at Queen Street Station is carried by a central, or third rail on the line, and is conveyed through pulleys and wires to the carriage lamps. The middle rail, which runs the whole length of the tunnel, is made of tee iron, and stands four or five inches higher than the ordinary line, on insulators of glazed fireclay about five feet apart. On the bottom of each carriage, at a height corresponding to the rail, are two contact-makers or pulleys of crucible cast steel, fifteen inches in diameter, hung on a center so as to move horizontally, and having spiral springs which allowed them to rise three or four inches. Wires from the contact-pulleys are connected to two 16 candle power Swan lamps in each compartment, one on either side of the ordinary roof lamp; but only one is lit at a time, the second being a reserve which automatically lights itself in the event of its neighbor failing. By this system the light appears whenever the train enters the tunnel, and disappears whenever it leaves it; and, as there are no connections between the carriages, the train can be broken up or shunted in the usual way, while the light is maintained whether the carriages are in motion or at a standstill. The current is produced from a large "Crompton" compound-wound, self-regulating dynamo, at the Queen Street High Level Station, always kept running. In the central rail the current of electricity is so low in potential that some men touching it did not feel it all, while others were slightly affected by it. The power required for each train was about 2,000 "watts," or from two to three horse power. It is possible to have seven trains in all on the three circuits into which the tunnel is divided, the point furthest away from the dynamo being at a distance of one mile and a fourth. During the five months the trial had lasted, out of sixty lamps on two trains three had to be renewed, though two of these were maliciously destroyed. The cost of the system was a fourth less than that of either of the other two, and a third less than that of gas; while the working expenses, though about the same as the others, were a third beneath those of gas."

Edison Central Station Work.

A number of plans for large central stations are now receiving skilled attention in the office of Mr. J. H. Vail, general superintendent of the Edison Electric Light Company, 16 and 18 Broad street, New York. Among these are Minneapolis, Minn.; Kansas City, Mo.; Mobile and Birmingham, Ala., and additional central stations in New York and Boston. At St. Paul the station started up February 1st, and has been running ever since, without any change or repairs. The same applies to the well-patronized new station at Topeka, Kansas.

It is easy to understand the uniform excellence of the work to be seen in all Edison central stations of to-day, when it is known that every plan is made in the office of General Superintendent Vail, and a close inspection made of the station on its completion. The inspector is in every case a skillful, experienced man, whose reports, graphically illustrated by pen drawings, are kept on file for immediate reference, should this be required at any time. Exterior and interior views, the steam plant, the electric plant, all the details, are carefully sketched by the inspector, and present a comprehensive picture of the station, covering every essential necessary to a thorough knowledge of its construction, location, dimensions and appearance.

More Thorough Examination Required in the Patent Office.

To the Editor of Electrical Review:

As several electrical papers are discussing the subject of United States patents and the Patent Office, and some inventors have complained of the inefficiency of examinations, I wish to call your attention to a case similar to "Electric Welding in 1882," and hope other victims will speak out, that the present slovenly practice in the examiner's department may be exposed and a reform effected.

In October, 1885, two patents, Nos. 328,687 and 328,948 were granted to Theo. L. Kauffer, covering very broadly the use of bichromate of soda in galvanic batteries. On the *prima facie* evidence of the originality of the claims, as passed by the examiners in the Patent Office, a strong company was formed which bought the patents. After spending several thousand dollars perfecting devices to operate the invention, it was accidentally discovered that a Frenchman named Bruoit Jarriant had used soda in galvanic batteries and had taken out a patent thereon both in France and England, the latter in April, 1882 (Thos. John Handford, No. 1,956). As Jarriant had the right to apply for and take out patents in the United States, his invention not having been used publicly here for two years, Jarriant's rights (?) were purchased and his applications filed here. He was put in interference with Kauffer, and, to save time and expense to the company, Kauffer conceded priority to him and a patent (No. 2, covering bichromate of soda in batteries No. 349,222, Sept. 21, 1886) was granted and duty assigned to the aforesaid company. Again, relying on the scrutinizing search of the examiners, who must have felt keenly the chagrin of their former oversight, more money was expended, licenses were issued, rights to territory and royalty stamps were sold, until news was received from London that another English patent covering the use of bichromate of soda in batteries had been found on file in the British Patent Office dating as early as 1871, so early, indeed, that the fourteen years of its term had expired, and consequently every other patent respecting soda in galvanic batteries—including Kauffer's and Jarriant's—was worthless, and neither of these patents should have been passed by the examiners nor issued by the Patent Office. There is no excuse for overlooking prior patents of public record; and this glaring defect in the examiner's department should be immediately remedied or the value of United States patents and public confidence in our system will be wholly destroyed. It seems nothing less than a duty to call attention to the present state of things, and it is hoped you will publish every instance of the kind which comes to your notice.

DE CEIVED.

Boston, May 14.

Ghosts Patronize the Electric Light.

My brother, the stage man of Dodge City, tells me that there is a wonderful valley down on his Panhandle of Texas stage line. It is a narrow, long valley, with jagued, rough and precipitous sides. Evidences of comparatively recent volcanic action are visible all through that section, and especially in that immediate locality. Just as the mild stars are drawing their sweet faces from the sky my brother tells me that not one, but fifty, electric lights appear rising from the ground in various parts of the valley. The stage drivers say that the lights are brought by the ghosts of murdered men who come back to revisit their earthly scenes. Others think there is valuable mineral in that section, and still others—and of the most superstitious sort—think this is the valley in which the Benders' butchers were hung, as it is a very secluded valley, and that the restless spirits of these fiends come back to haunt their captors.

I don't know anything about the causes of the weird and wonderful lights. I only know that my brother is a stiff Methodist and his statements as to the lights can be implicitly relied upon. He has been engaged in the stage business for twelve years out on the plains, and knows a Jack-o'-lantern from a tallow dip when he sees it.—*Cor. Globe-Democrat.*

A Portable Hand Dynamo, and a Question of Self-Induction.

One of the smallest self-exciting dynamos is a little machine made by Mr. G. Bowron (of 97 Crawford street, W.) London, weighing 5½ pounds, and from which, when driven by hand, an output of 12 watts can easily be obtained. This is not by any means a bad performance for a machine of the size, as we have described dynamos weighing (with their bed-plates) something like 50 times as much, and with no greater output per pound of dead weight. This little machine has a Siemens shuttle-wound armature, with half an ohm of No. 22 wire, and provided with a two part commutator; the magnets are shunt-wound to a resistance of 4 ohms. The commutator is made rather long, and the insulation strips are wedge shaped, so that different effects are produced by sliding the brushes to a different part. When the brushes rest on the part of the commutator where the insulation is narrowest the machine gives a tolerably uniform current; but when the wide part of the insulation is underneath the brushes the field is more or less demagnetized twice in every revolution; thus the E.M.F., although continuous in direction, undergoes considerable variation in amount. Under this adjustment the apparatus is therefore capable of performing the occult and mysterious *rôle* of a "medical coil." Mr. Bowron has noticed, notwithstanding the field magnets are shunt-wound, that the machine will not excite when the brushes are on this part of the commutator, unless the external resistance is below a certain limit. This is a somewhat curious point; but it seems to us that the explanation is to be found in the following considerations: It is known that the duration of the "extra current" (or, more strictly, the time occupied in falling to any given fraction of the first value) varies inversely as the resistance of the circuit, provided that the self-inductive coefficient remains constant. Therefore when the external circuit of the dynamo remains open the magnetism of the field has time to fall below the minimum required for self-excitation before the armature is again brought into circuit. As the resistance of the external circuit is reduced from infinity the period of demagnetization lengthens until exciting power is recovered. This experiment seems to point to a method of investigating certain questions connected with the "variable period," which might prove of value, especially in the determination of the influence in this respect of Foucault currents—a matter which is not easily brought under calculation. For lecture purposes the experiment should also prove decidedly useful.

Electric Lighting in Rochester.

One of the most extensive and expensive improvements recently made in Rochester, N. Y., is that of the United States Electric Lighting Company on the verge of the Genesee Falls, 209 North Water street. The premises are the old stone mills erected away back in the twenties by a man named Cleveland. The buildings and water power were purchased by the local company and have been reconstructed and enlarged from the foundation, and now constitute a roomy and exceedingly substantial structure, well suited to the purpose to which they have been put—that of an electric light station. A strong stone wall has been built on the west side as a breakwater, and the rock blasted out so as to give a sheer fall of 90 feet within the building, which, from the foot of the cataract to the roof, is eleven stories high. The water power machinery was put in by the Jno. T. Noye Manufacturing Company of Buffalo, and is among the finest, best finished and most powerful of the kind in this country, embracing the Leffel twin water wheels made in Baltimore, Md. There are eighteen United States dynamos now in operation, and a larger one is still to be added. The building is admirably suited to the purposes intended, having light on all four sides. A huge iron beam, the largest in the city, extends from rock to rock and supports the entire superstructure. J. A. Almstead is superintendent of the station, with Charles Torrance as clerk.

It is claimed that this is the largest and best equipped electric light station yet erected in Rochester, and will soon be running up to its full capacity. All the machinery and apparatus have thus far worked in the most satisfactory manner. It is pointed out that the character of the service for both arc and incandescent lights is indicated by the fact that the allowances made for defective service in cities where it is in use have been less than 5 per cent. of the total earnings, which shows that the service has been not only uninterrupted, but very successful to customers.

The station, at the brink of the Falls, is well worth a visit of inspection.

Effect of Electrical Currents on Living Matter.

M. D'Arsonval has recently published the results of his elaborate experiments on the effect of currents of electricity in destroying life. An electric current destroys life by direct action, *i. e.*, a destruction of living tissue; or indirectly by affecting the nerve centers. In the second case only can the unfortunate subject be occasionally brought to life by artificial respiration applied immediately after the accident.

1. A static discharge is fatal only when acting upon the medulla oblongata with an amount of energy corresponding to 20 foot pounds. The nerves, blood, and muscles lose completely their physiological functions. A less discharge stops respiration, the heart's action, and produces paralysis.

2. With a battery current of 420 volts, death is caused only by frequently breaking the circuit for a considerable time. Death is due to tetanus (lockjaw).

3. A continuous current machine is dangerous only on account of the self-induced current when the circuit is broken. Compound or shunt wound are less dangerous than series wound machines.

4. An alternate current machine causes death only when the electromotive force is above 120 volts mean difference of potential.

—— In the city of Harrisburg, Pa., two electric light companies are waging a war before the Appropriation Committee for the contract for lighting the public buildings and grounds. The contract has been already awarded to the Edison Company for $12,000 a year by the Board of Public Property. A Brooklyn company want this contract annulled and a new one advertised for, claiming that they can furnish the light for $6,000 a year. It is not probable, however, that the committee will interfere with the award already made.

—— H. A. Foster contemplates establishing an electric light plant in Richmond, Me.

—— The Kankakee Illuminating Company, of Kankakee, Ill., has been incorporated. Capital stock, $10,000. Walter W. Hatch, and others, incorporators.

—— The Nyack Electric Light and Power Company, Orangetown, N. Y. (P. O. Blauveltville), has been incorporated. Capital stock, $20,000. James A. Blauvelt, and others, incorporators.

—— There are 14 miles of underground tubing of the Edison system in the city of Detroit and over 7 miles in Rochester, N. Y. In New York city there are down in the lower part of the city 26 miles. The two stations which are being planned for the upper part of the city will probably require double that number, if not more.

—— The combination of gas and electric lighting is gradually going on. The Columbus Gas Company, of Columbus, Ind., began the electric lighting business about a year ago, buying a 45-light Thomson-Houston machine. They have now increased their plant by an additional 50 lights, and have purchased a plant from the American Company, which is giving much bettter satisfaction than the Thomson-Houston.

—— The Staten Island Amusement Company, through its president, Erastus Wiman, on Monday closed a contract with the American Electric Manufacturing Company, for a 164 light plant for St. George and Erastina. The Brush apparatus was used in both places last year, all of which is to be discarded for the American system. This order was taken by Mr. Thomas Grimwood, one of the livest agents of the American Company.

—— Of all forms of artificial illumination, the incandescent electric light, so far as facts now go, is the best. Among 1,100 persons who worked by this light, Dr. Andrews found not a single case of injury. On the other hand, many persons testified to the fact that they could work longer by it with less fatigue than with the gas or oil light. This is due, it is found, to the steadiness, absence of heat, and perhaps the greater proportion of violet rays. Short sighted persons are, in particular, benefited by the use of the incandescent lamp.—*Medical Record.*

—— The Brush Electric Light Company, of Detroit, Mich., whose enterprise has made that city one of the best lighted cities in the country, are building a new station, which will have increased capacity, and they have just ordered five more 13x12 Ball Automatic Engines of Erie, Pa., and this company has just sold five large engines through their agent H. M. Sciple & Co., of Philadelphia, to Strawbridge & Clothier, of Philadelphia, Pa., who are fitting up one of the largest dry good stores in the country, and which will be entirely lighted by electricity.

—— At the annual meeting of the stockholders of the United States Electric Light Company of Rochester, N. Y., the following were elected trustees for the ensuing year: W. H. Gorsline, L. P. Ross, Jas. C. Hart, H. Austin Brewster, A. S. Mann, Dr. Jonas Jones, Alex M. Lindsay, Jas. M. Whitney, Chas. F. Pond, R. M. Myers, C. H. Babcock. At a subsequent meeting of the trustees, the following officers were elected: W. H. Gorsline, president; L. P. Ross, vice-president; H. Austin Brewster, treasurer; C. H. Babcock, secretary.

—— A new catalogue has been issued by the United States Electric Lighting Company, 120 Broadway. It is an artistic, elegantly printed and interesting publication. While the contents, which are handsomely illustrated, do not do any injustice, very naturally, to the electric system described, they comprise instructive and valuable electrical information presented in a most creditable manner. A more strikingly-covered catalogue has not appeared in electrical circles.

ELECTRIC LIGHT NEWS

—— The St. Augustine Gas and Electric Light Company, St. Augustine, Fla., will erect a building to cost $40,000.

—— The Roanoke Electric Light Company, Roanoke, Va., has been organized, with Henry Fairfax president.

—— Syracuse, N. Y., is asking for more electric lights, and will probably secure an increase of the present plant from 110 to 250.

—— The East River Electric Light Company have purchased of the Thomson-Houston Company 1,000 lamps and several large dynamos.

—— The Chicago *Tribune* thinks electricity a heavy subject for a lecture. Here in Boston, says the *Commercial Bulletin*, men make light of it.

—— Electric light has been introduced into the large manufactory of Benj. Hey & Co., Cincinnati, O. The Loomis system was the one selected.

—— The Paris Gas Company, of Paris, Texas, have just contracted with the American Company for a large arc plant, which is now being installed.

—— The Larned Electric Light Company, Larned, Kan., has been incorporated. Capital stock, $35,000. Chas. E. Campbell, and others, incorporators.

—— The experiment of lighting Mable avenue, Clifton, S. I., with electricity was successfully carried out, and Mr. Erastus Wiman is promoting the organization of a local lighting company.

—— The king's palace at Honolulu is being lighted by the Thomson-Houston arc and the Sawyer-Man incandescent systems. There will be 500 Sawyer-Man incandescent lamps used in the installation.

—— The Petit Flouring Mill, Minneapolis, is being wired preparatory to the introduction of the Sawyer-Man electric light system. Seventy incandescent lights will embrace the outfit, and about two weeks will be required to get the system ready for use.

—— There are 800 Brush arc lights in the city of Baltimore, and 150 United States all under the same management. A number of Baxter motors are in use in the city, in several places displacing steam engines. These motors are in use also in Boston and Troy.

—— The City of Boston gave Queen Kapiolani a very elegant ovation. Mayor O'Brien gave a breakfast at the Parker House to the queen and suite, and about thirty guests. The electrical fraternity were represented by Fred A. Gilbert and wife, S. S. Sias and lady and General C. H. Barney.

—— The Westinghouse Company have purchased an interest in the Brush Electric Light Company, of Pittsburgh, and Samuel A. Duncan has been appointed general manager. They have four central stations, now operating in Allegheny City and Pittsburgh, for incandescent and arc lighting.

—— The Halifax Gas Company, Halifax, Nova Scotia, one of the oldest and most conservative gas companies on the continent, have just contracted with the American Company for a 100-light plant. This order was given after Mr. Baxter, the general manager of the company, had made a full examination of all the systems of the United States.

—— The new carbon combination now under the management of E. C. Hawks, of Cleveland, has appointed that popular and energetic carbon agent, George F. Porter, of New York, their representative for the Middle States; Mr. C. D. Smith, of Boston, for New England, and J. B. Krouse, of Cleveland, for the West and South. These gentlemen are well known in this field.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING MAY 10, 1887.

362,510 Regulator for dynamo-electric machines; Enos T. Higham and Daniel Higham, Philadelphia, Pa.

362,531 Voltaic battery; August F. W. Partz, Philadelphia, Pa.

362,594 Electric battery; David Misell, New York, N. Y.

362,639 Method of working and forming secondary battries; 362,640, Secondary or storage battery; Washington L. Ludlow, Cleveland, Ohio.

362,652 Testing apparatus for telephone exchange switches; Joseph J. O'Connell, Chicago, Ill., assignor of one-half to Albert Clare Holland, same place.

362,682 Loop insulator; Horace Van Sands, New York, N. Y.

362,739 Automatic electric danger alarm; John J. Ghegan, Newark, N. J., assignor of one-half to Andrew Albright, same place.

362,798 Electro-dynamic motor; Charles J. Van Depoele, Chicago, Ill.

362,847 Electric battery; Orazio Lugo, New York assignor to Colin M. Thompson, Brooklyn, N. Y.

362,852 Electric lamp; Charles M. Noble, Anniston, Ala.

362,859 Variable electric resistance; J. M. Stearns Jr., Brooklyn, N. Y.

362,872 Insulating the terminals of sheathed electrical conductors; David Brooks, Philadelphia, Pa., assignor of one-half to Henry B. Tatham same place.

362,902 Circuit controller for self-winding clocks Chester H. Pond, Brooklyn, N. Y.

BUSINESS NOTICE.

"In making the statements which follow we can verify each and all of them as facts. Mr. Edward P. Thompson, of Temple Court [7 Beekman St.,] New York, is a good man to bring your patent cases to, for he is thoroughly versed in all the ins and outs of a Patent Attorney's duties. The following are some of his qualifications: Graduate of Stevens Institute as Mechanical Engineer. For four years tutor of classes of young men in mathematics and experimental physics at Elizabeth, N. J. Served professionally as Electrician and Chemist in the Swan Electric Company of New York for two years. Because of past successes as a Patent Attorney at 13 Park Row, New York, was appointed, to succeed N. S. Keith, of the patent agency of the *Electrical World* and Associate Editor. N. S. Keith is known as the Translator and Reviser of Schellen's Treatise on "Dynamo Electric Machinery." Mr. Thompson for two years personally prepared and prosecuted all the patent business of *Electrical World's* Patent Agency, and is the author of a series of articles in said paper upon "Analytical and Systematic Method of Inventing," which were widely known and favorably received. Mr. Thompson is a member of American Institute of Electrical Engineers and American Society of Mechanical Engineers. He is author of the "Expansion of Polynomials," which the ablest mathematicians of the world universally commend." —*New York Observer*.

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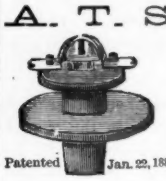
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Brush Electric Co., Alex. Kempt, Special Agent.
Excelsior Electric Co., C. J. Reilly, Western Mgr.
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J. H. Reid, General Manager of the Mather Electric Light Co., Chicago.
Wm. H. Purdey, Comm. of Public Works, Chicago.
John Mab, Chief Engin'r of Board of Trade, Chic.
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